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OCTOBER, 1909

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NOTICE.—Owing to the increasing cost of the *Aëronautical Journal*, the Annual Subscription has been raised to Six Shillings.

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[*For the opinions expressed in papers that are signed or initialled, the Authors alone are responsible. None of the papers or paragraphs must be taken as expressing the opinion of the Council unless such is expressly stated to be the case.*]

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NOTICES
OF
The Aëronautical Society of Great Britain

At a Council Meeting of the Aëronautical Society of Great Britain, held at Dagenham Dock Experimental Ground on Wednesday, August 18th, 1909—

1. The undermentioned gentlemen were elected members of the Society:

MR. F. J. SELBY
MR. E. W. YOUNG, C.E.
CAPT. H. W. FORSYTH, R.E.
DR. A. DYES
MR. P. NARRAWAY
MR. V. GABRIEL, C.V.O., I.C.S.
MR. A. H. MOREING
MR. H. B. MOLESWORTH. C.E.
THE RT. HON. THE EARL OF HARDWICKE
MR. C. H. SEELY
MR. A. W. SMITH
THE HON. H. S. LITTLETON
MR. V. LLOYD LE CREU
SIR J. SHELLEY, BART.
MR. C. S. GRACE
MR. P. R. GRACE
MR. H. DELACOMBE
THE HON. C. S. ROLLS
MR. S. F. BARCLAY, A.M.I.C.E.
MR. E. PETRE

To date August 18th, 1909.

2. It was decided to award the silver medal of the Society to

S. F. CODY, ESQ.

for his services to aëronautics.

The following letter was sent to Mr. S. F. Cody:

Dear Sir,—I am directed by the Council to inform you that at the Council Meeting held at Dagenham Dock on

Wednesday, August 18th, 1909, it was decided to award the silver medal of the Society to you for your services to aëronautics.

I am also desired by the Council to say how much they appreciate the hard work that you have done in connection with aëronautics, and to congratulate you on your recent successful flights.

I am, Sir,
Yours faithfully,
J. D. FULLERTON,
Col. R.E. (ret.).
Hon. Secretary.

August 20th, 1909.

Reply from Mr. Cody

Dear Sir,—My surprise was only exceeded by my extreme pleasure on learning that the Society had seen fit to award me its silver medal. I cannot express in words my appreciation in the matter.

I remain,
Yours faithfully,
S. F. CODY.

At a Council Meeting of the Aëronautical Society of Great Britain held at the Society's Offices on Wednesday, October 13th, 1909:—

1. The undermentioned gentlemen were elected members of the Society:

MR. P. BONO
MR. A. GREEN
MR. D. G. GILMOUR
MR. W. COCHRANE
LIEUTENANT E. ST. G. KIRKE, R.E.
MR. J. L. BRERETON
MR. A. STEWART
MR. C. GURNEY GRIME
MR. T. DE GUERIN
MR. T. B. BAKER
MR. R. BESLEY
MR. W. CARR
MR. J. E. BECKETT
COLONEL G. M. HEATH, R.E.
MR. JOHN CASE

2. It was decided that the life membership subscription should be raised from £10 10s. to £15 15s., as from January 1st, 1910.

3. It was also decided that an entrance fee of £1 1s. be imposed on all members joining the Society subsequent to January 1st, 1910.

MISCELLANEOUS NOTICES

1. The Council desire to thank the donors for the following books, papers, etc., presented by them:

By COLONEL TROLLOPE (late Grenadier Guards)
La Conquête de l'Air (current numbers).
Some papers and pamphlets.

By MR. PATRICK Y. ALEXANDER
"The Aëro-Manual."
Large Print of Dirigibles.

By MR. E. S. B. MACKENZIE-HUGHES
Automatic-stability Model.

By PROFESSOR A. L. ROTCH
"The Aërological Congress at Monaco."

ANONYMOUS
Framed Balloon-Post Envelope of the Siege of Paris.
"Le Code de l'Air," by Gaston Bonnefoy.
"A History of Balloons and Balloon Voyages," by F. Marion.
Encyclopédie de l'Aviation (current numbers).

By the SMITHSONIAN INSTITUTION
Fifteen Pamphlets relating to Birds and Bird Flight.

By MR. JAMES MEANS
Rare back numbers of the *Aëronautical Journal.*

The following books have been received from the Publishers:

"Aërial Navigation of To-day," by Chas. C. Turner (Seeley & Co.).
"Fliegende Menschen," by H. W. L. von Moedebeck (Berlin: Otto Salle).
"Practical Kites and Aëroplanes," by Frederick Walker (G. Pitman).
"The Highway of the Air" (Funk and Wagnalls).
"The Conquest of the Air," by Alphonse Berget (Heinemann).
"Through the Sun in an Airship," by John Mastin (C. Griffin & Co.).

2. The undermentioned books have been purchased for the Library:

"Prodromo overo saggio, etc.," by Francesco Lana (1670).

"Etat Actuel et Avenir de l'Aviation," by R. Soreau (1909).

"The Geometry of a Screw Propeller," by W. J. Goudie (1906).

3. The following telegram was despatched to Mons. Blériot on the occasion of his successful flight across the Channel:

"Many congratulations from the Aëronautical Society of Great Britain."

4. The following telegram was despatched to Mr. S. F. Cody on the occasion of his flight of 63 minutes on September 8th:

"Hearty congratulations on record flight, The Aëronautical Society of Great Britain."

5. The following telegram was despatched to the Aéro-Club de France on the occasion of the death of Captain Ferber:

"The Council and members of the Aëronautical Society of Great Britain desire to convey their deep condolence and sincere sympathy in the sudden and irreparable loss to France and to the science of aëronautics by the death of Captain Ferber."

6. The undermentioned members have been appointed to a Committee to consider the "aëronautical terms" in common use:

Chairman:

MAJOR B. BADEN-POWELL

Members:

MR. C. H. ALDERSON

MR. H. SYKES

MR. C. C. TURNER

MR. J. H. LEDEBOER

The Report of the Committee should be forwarded to the Hon. Secretary.

Automatic Speed Control for Flying Machines *

By A. P. THURSTON, B.Sc.

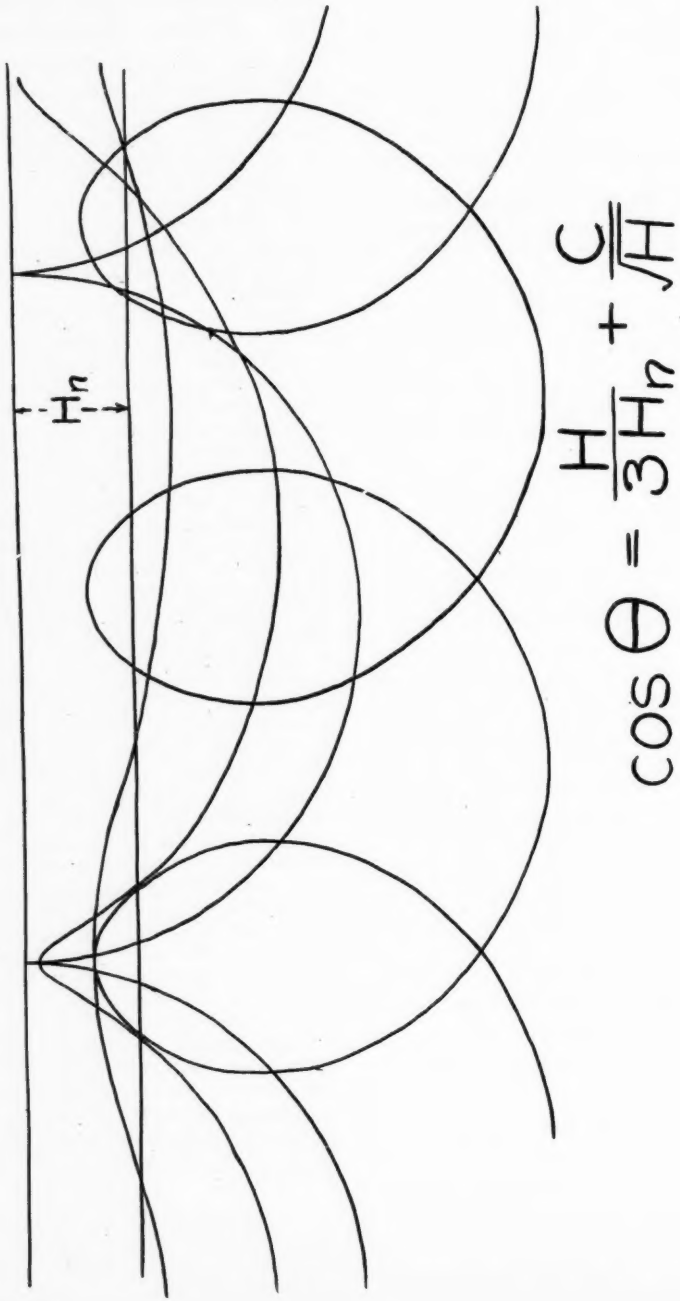
Mr. Chairman, Ladies and Gentlemen, I propose to describe very briefly to you this evening a simple little device known as a "Safety Automatic Speed Control for Flying Machines."

When a glider, which is both laterally and longitudinally stable, is launched it follows one of a number of paths according to the velocity with which it is launched.

There is a certain speed for every glider at which it will travel in a perfectly straight line. This speed is known as the *natural velocity* of the glider. If the glider is launched at any other speed it will follow a certain curved path. Prof. Bryant has succeeded in photographing some of these flight paths by attaching a piece of lighted magnesium wire to a glider and flying it in a dark room. (These photographs were published in the *Aëronautical Journal*.) By giving a glider a speed greatly in excess of the natural velocity it may be made to loop the loop. If the speed is not quite so great it may be made to travel over a quarter of a circle and to come to a point of instability at the cusp of the curve where it collapses. The same effect may be obtained, in frictionless flight, if the glider is allowed to drop vertically downwards. The underlying principle of these curved paths is that the sum of the potential and the kinetic energy remains a constant. The curved paths correspond to the swing of the pendulum, or, to use the hydraulic analogy, the "pressure head" and the "velocity head" remain constant. The velocity of the glider is therefore a maximum when it is at the bottom of the curve, and a minimum when it is at the top. Mr. Lanchester, by utilising this principle and by taking into account the centrifugal action on the glider and the change in the point of application of the centre of pressure with a change in the inclination of a plane, deduces a differential equation the solution of which is:

$$\cos\theta = \frac{H}{3\,Hn} + \frac{C}{\sqrt{H}}$$

* Read at the General Meeting of the Aeronautical Society of Great Britain on Wednesday, July 14, 1909. [See p. 85.]


H_n
$\cos\Theta = \frac{H}{3H_n} + \frac{C}{\sqrt{H}}$

Where

H = depth of the plane below the datum line at any instant,

Hn = depth below the datum line through which the body would be required to fall in order to acquire a velocity equal to the natural velocity.

C = a constant, the value of which differs for every flight path.

Some of these paths are plotted in the diagram. There are, of course, an infinite number of paths. The semi-circular path has a radius of 3Hn. Thus, if the natural velocity of an aeroplane is 40 miles an hour

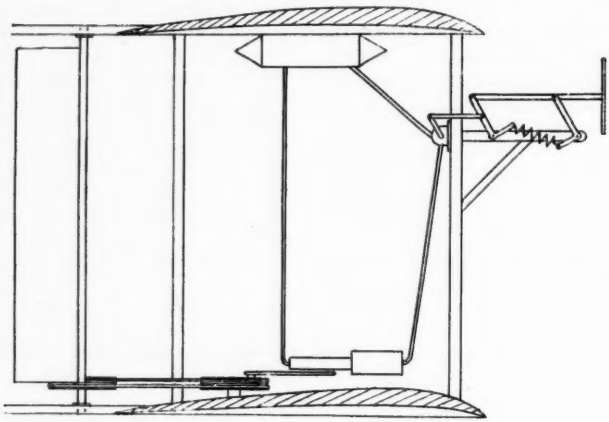
$$\text{Since } v^2 = 2g \text{ Hn.}$$
$$\therefore \text{ Hn} = 53{\cdot}5 \text{ ft. nearly.}$$
$$\therefore 3 \text{ Hn} = 160{\cdot}5 \text{ ft.}$$
$$\therefore \text{Since } v_1^2 = 2g\,(3 \text{ Hn}).$$
$$\therefore v_1 = \text{nearly } 102 \text{ ft. per sec.}$$
$$\text{or } 69{\cdot}5 \text{ miles per hour.}$$

That is an increase of speed of $29\frac{1}{2}$ miles an hour would cause the machine to come to a point of instability.

Now a sudden gust of wind is equivalent to an increase of speed of the machine. Thus, if a machine is flying at its natural velocity and meets a sudden gust of wind, it may describe a quarter of a circle and arrive at a point of instability at the cusp of the curve, or it may loop the loop. This would be very unpleasant in an actual flying machine. I remember I was once flying a large model in Thurlow Park; I had flown the model several times and it was thrown at approximately the same speed on every occasion. On the last occasion just as it was launched a very heavy gust of wind of about 30 miles an hour swept round the house and, to my surprise, the model rose fully a hundred feet, passed overhead upside down, passed behind, came into a vertical position with the nose pointing downwards, commenced to turn inwards again, and finally landed in a large elm tree before it had fully completed its loop. My device, which I invented some time ago now, is for automatically reducing the speed, when it is too high, by applying a brake.

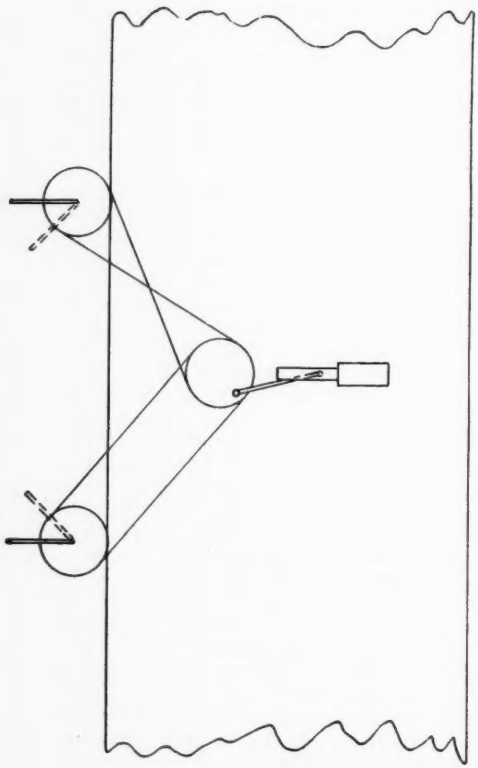
It consists of a vane, as shown in the diagram, preferably mounted in the front of the machine and perpendicular to the line of flight. This vane is mounted on a rod which is pivoted to two bell-crank levers, as in Sir Hiram's classic anemometer, which levers are pivoted to the body or any part of the machine. The short arms of the bell-crank levers are connected by a spiral tension spring. Thus, as the pressure of the air increases the bell-crank levers will swing back and the spring will be elongated. One of the bell-crank levers is provided with a projection which is connected to the arm of a "relay," so that when the pressure on the vane exceeds a certain amount the relay will switch into operation a larger power. This power may be electrical, compressed air, steam, or any other power. Preferably, I use compressed air. This power operates two rudders or brakes, preferably vertical, and preferably placed behind the machine, but they may be placed anywhere. These rudders are thus caused to rotate in opposite directions so as each to form a resistance to the wind and thus to balance each other's side thrust. A brake is thus applied to the machine, the intensity of which depends upon the extent to which the relative speed exceeds the natural velocity of the machine.

When the speed of the machine has been suitably reduced the tension spring returns the vane to its normal position and at the same time operates the relay in the opposite direction. This allows either the pressure of the wind to return the vertical planes to their normal position edge-on to the wind, or it switches in a power to so return them. Preferably, a compressed air cylinder of two diameters is used, in which a piston having two diameters is mounted. Thus, for throwing the rudders into operation, air is allowed to enter, by means of a three-way valve, into the larger part of the cylinder and so to operate on the large piston, and for restoring the rudders to the normal position air is allowed to enter, by means of the relay, into the smaller part of the cylinder, and thus to operate on the smaller part of the piston. The rudders are not necessarily vertical, and there may be more than two, but their number should preferably be a multiple of two in order that the side thrust of each may be neutralised. These rudders may be the rudders now used for steering, in which case the



ELEVATION

Fig. A



PLAN

Fig. B

ordinary operating means is switched out by means of a clutch when the brake mechanism is thrown in, or the rudders may be auxiliary to the ordinary apparatus. If desired, the braking device may be thrown into operation by hand. To enable this to be done the relay, which consists preferably of a three-way valve, may be provided with a handle, or it may be duplicated and provided with a handle. The automatic device may be thrown out of action by locking it, as, for instance, by placing a stop against one of the levers. The device would be especially useful in the case of aërial torpedoes, where it would be very important to keep the torpedo travelling without deviation from the path in which it had been set.

I have been especially asked to describe to you this evening the apparatus which I used to test the flow of air through propellers and about aeroplanes and other bodies. The apparatus consists of a series of capillary tubes set at fixed distances apart, and all radiating from a central main tube. Air is passed from a reservoir and is blown downwards in a fine jet upon the surface of hydrochloric acid contained in a bottle. The air and hydrochloric acid gas are then passed from this bottle and are blown down upon the surface of strong ammonium hydrate contained in a second bottle. A dense white smoke is obtained immediately the air impinges upon the surface of the ammonia. This smoke,

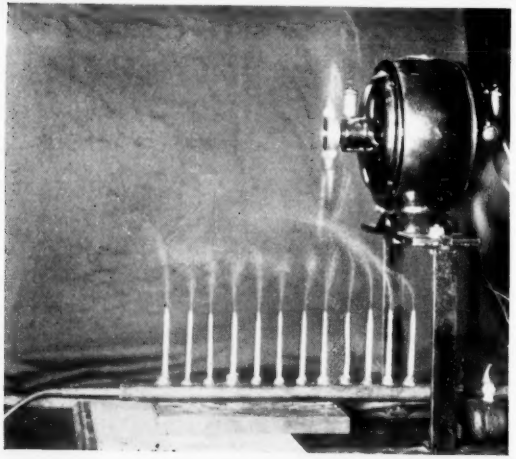
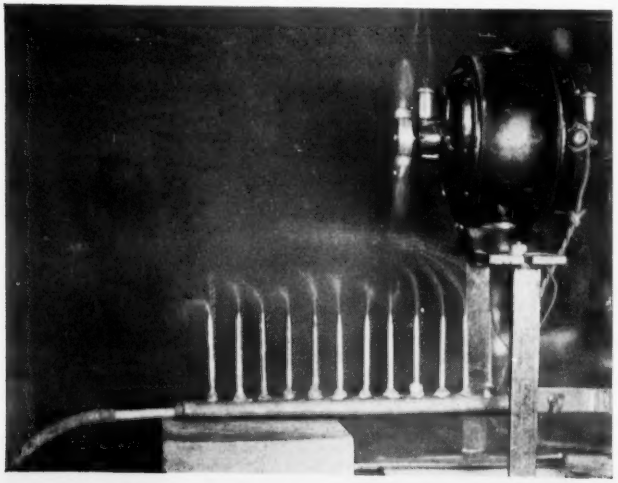


Fig. 4



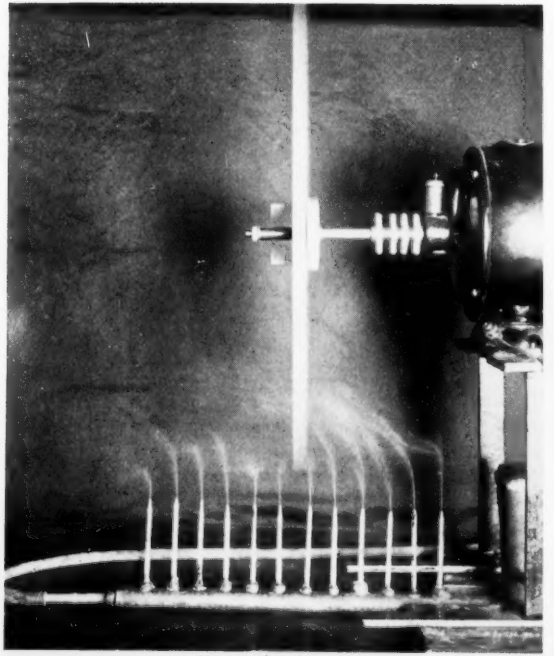


Fig. 9.

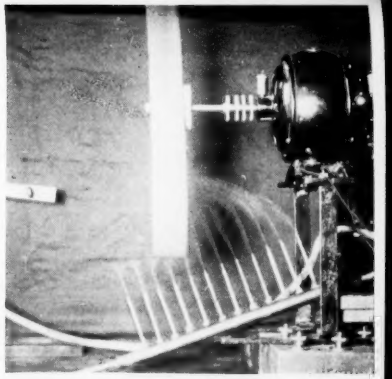
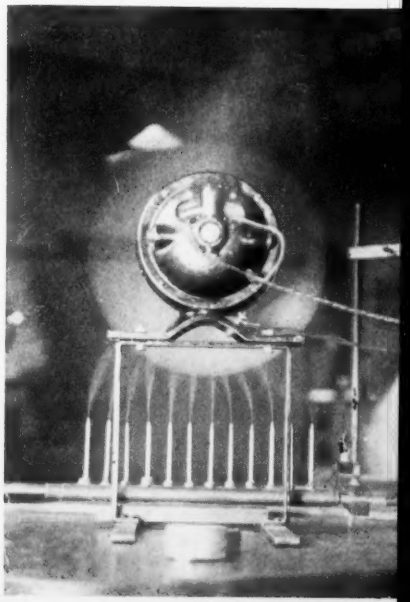


Fig 6



which is exceedingly light, then issues from the capillary tubes in dense fine lines, separated by a known distance. It is thus possible to make a most interesting and instructive series of observations

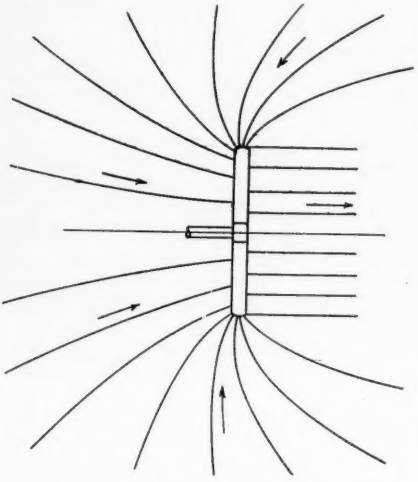


Fig. 1

of the air flowing over aeroplanes and bodies of all kinds and shapes, and through propellers. I have carefully studied these lines of flow, but have not yet had time to take many photographs. However, owing to the kindness of Mr. F. G. Field, I am able to show you lantern slides this evening of a few preliminary photographs which we have taken. I hope to show at a later date some better photographs.

The action of a propeller differs from that of an aeroplane in that the blades are continually passing over the same spot, generally many times in a second, and thus are running in air which has already been disturbed. If we knew exactly how the air was affected it would be a comparatively easy matter to calculate the thrust. It was long thought that a running propeller flung the air out radially. When Sir Hiram started his experiments he was told that, although screw propellers were very efficient in water, they were quite useless in air because they produced a strong fan-blower action. It was, therefore, necessary to test the flow of air about a propeller, and this was done by means of short ribbons held in determined positions. The lines of flow were carefully observed and it was found that there was not the slightest sign of a fan-blower action until the pitch exceeded three times the diameter of the screw. Then the air was in an unstable state, and fan-blower action alternated with the previous inflow at the circumference.

Fig. 1 shows these curves plotted. The air leaves the propeller in a steady column, which has only a slight spiral action and, instead of there being a centrifugal action, the air actually flows in at the circumference.

Fig. 2 shows one of the flat-bladed brass propellers belonging to the Aëronautical Society. The propeller was running at 1,050 revolutions per minute when the photograph was taken.

Angle of blades ... = 19°.
Diameter of propeller = 12 ins.

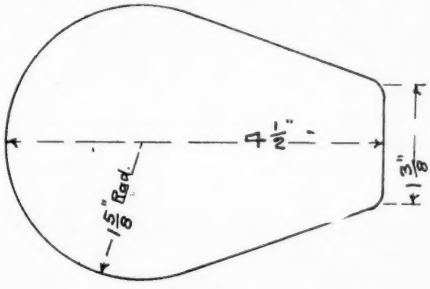


Fig. 3

Two blades shaped as shown in Fig. 3.

Fig. 4 shows the same propeller running at 550 revolutions per minute.

Fig. 5 shows the radial infed on the same propeller running at 830 revolutions per minute.

Fig. 6 shows one of Sir Hiram's model propellers which he used in his classic experiments. This is one of the three propellers which he found gave the best results. The blade is a true helix everywhere. Pitch angle at the tip = 23.5°.

Diameter ... ... = 17½ ins.
Revs. per min. ... = 240.

It will be seen that the air is driven off in a cylindrical column.

Fig. 7 shows the same propeller with the stream lines entering axially. The shapes of the stream lines through the propeller can be distinctly traced. Revolutions per minute = 240.

Fig. 8 shows a small propeller 6 ins. in diameter. The air is driven off in a

column, the diameter of which increases with the distance from the propeller.

Fig. 9 shows an aërodynamic paradox, which was discovered by Sir Hiram. The blade of wood is shaped, as shown in

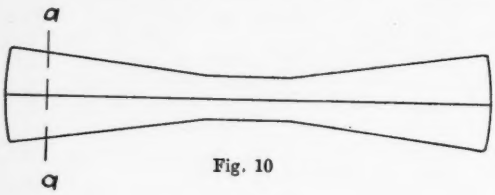


Fig. 10

Fig. 11

Figs. 10 and 11. Fig. 11. is a section on the line a, a Fig. 10. This blade is mounted in Fig. 9 with the flat face towards the left of the photograph. It was found that it drove the air away from the flat face in a cylindrical column, no matter in which direction it was rotated. It also gave a considerable thrust.

Diameter ... = 17.4 ins.
Revs. per min. ... = 620.

Fig. 12 shows a wooden propeller having central arms. The blades were concavo-convex.

Diameter ... ... = $17\frac{1}{2}$ ins.
Pitch angle at circumference = 49.5°.
Revs. per min. ... ... = 550.

The air was driven off in a great cone having an apex angle of about 100°. Fan- this pitch angle. This is shown in the photograph.
blower or centrifugal action occurs with

Fig. 13 shows the stream lines flowing over an aëroplane, eight inches wide. The discharge shown here was not suitable for tests in moving currents of air owing to the disturbance caused by the thick body. Nevertheless, a stream line can be seen closely hugging the back of the aëroplane, and, in the original negative, it is seen that the stream lines above and below the plane are deflected downwards.

DISCUSSION

Captain CARDEN: Mr. Chairman, Ladies and Gentlemen, I should like to ask one question of Mr. Thurston, whether he has made any experiment with his automatic speed controller apparatus, because it seems to me that its action is likely to be rather late. And also there is the question of how large the rudder surfaces must be, that is to say, the brakes must be, in order to have any effect on a full-size aëroplane. I should like to know, therefore, whether Mr. Thurston has made any experiments either on a model or a full-size aëroplane. What I mean by late action is that the aëroplane may have reached the cusp of the curve before the brake has any effect.

Mr. T. W. K. CLARKE: Mr. Chairman, Ladies and Gentlemen, in connection with this it would be probably interesting to hear of some experiments Mr. Weiss made in a similar manner. On some of his gliders he put a weight by attaching a large clump of cotton wool, and it had just the effect which would be desired, that is, instead of going along in a certain downward path, was at a much steeper angle, so that the effect was sufficient.

Mr. J. HUMPHREYS: With regard to this question of the movement of the centre of effort, which is practically the question at issue, the reason of a plane turning and darting in the direction indicated is because the increase in speed causes the pressure to be further advanced and the plane to turn upwards. This difficulty can be overcome in another way, and I venture to suggest a more simple method, and that is simply and solely by arranging the pitch, if I may so use the word, of the planes, in the same way as one would alter the pitch of a wing, as to increase the pressure on the reverse side of the plane. As the centre of pressure advances it is obvious that the angle of wind force also advances, and that causes the pressure to advance on one side. It is possible also to cause the pressure to advance automatically on the reverse side in that way. If a body heavier than air is suspended in the air it is perfectly obvious that if it drops from a balloon the centre of effort of that body is in the centre of that plane. Directly it starts to move the centre of effort drops gradually forward, and it is, to all intents and purposes, as though that body were falling through the air at a definite angle and the angle is governed by the speed of the body. The idea that it is travelling through the air perfectly horizontally is wrong, because such a condition never exists with a heavier-than-air machine, and we have to design our glider on the

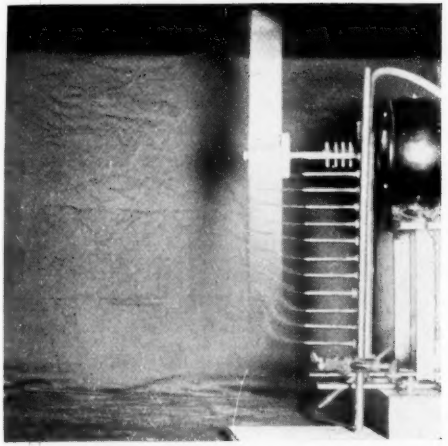


Fig. 7

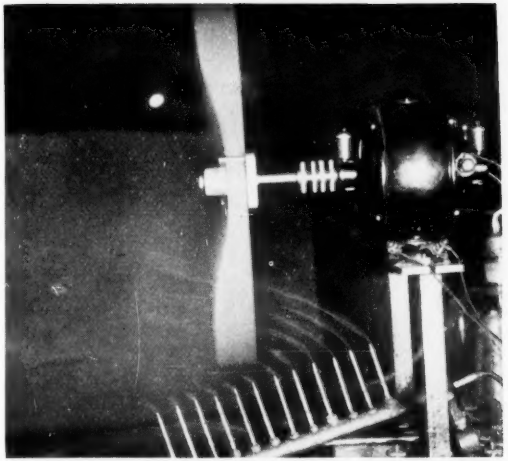


Fig. 12

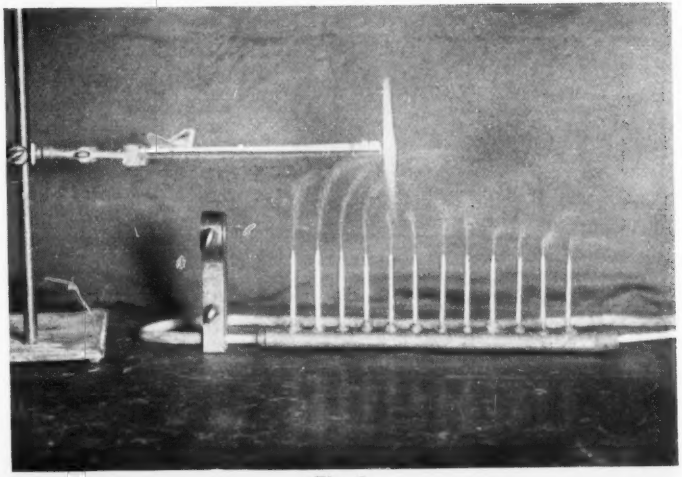


Fig. 8

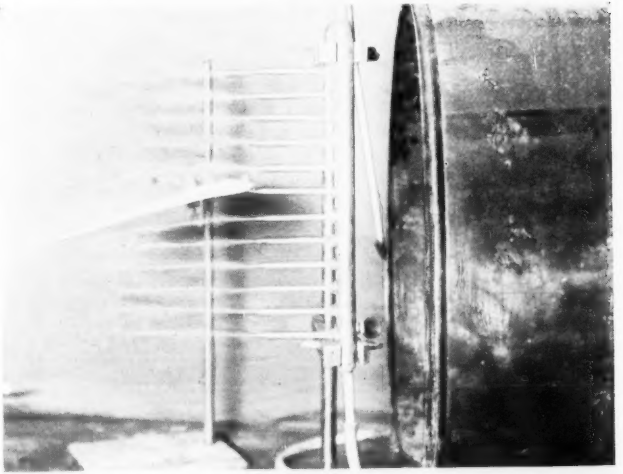


Fig. 13

basis of the angle which that machine will meet the air—either an angle at 90 degrees—supposing it drops from a balloon in perfectly still air the wind force would be at 90 degrees, and as the centre of effort moves forward, so you consider the wind force or the air force striking that machine is varying its angle. I am not in this question considering outside forces such as gusts of wind or anything of that sort. We have to consider the question of driving the body through the air at all speeds, varying speeds, all possible speeds we will say, and it is quite possible to so arrange these surfaces and so arrange that pitch as to cause that balance in the centre of effort. That is far better and simpler than the suggestion that has been put forward, not but that I think it is an exceedingly clever idea and automatic stability is desirable. At the same time I think the simpler the methods adopted for that purpose the better. I was very interested in Colonel Capper's remarks with regard to dirigible balloons, although they are rather outside the scope of the direction in which my work is taking, at the same time I think I have one suggestion to make, and it is this, that the dirigible balloon, being lighter than air and therefore also weaker than the element that it is in, is in the position of trying to overcome a force and is very similar to a tug-of-war team of lighter and weaker men opposed to a team both stronger and heavier, which would seem absurd. Therefore surely the method to be adopted is rather that of the Ju-Jitsu wrestler, and give to those forces and utilise those forces of the enemy against himself. I should be very pleased to make those suggestions to Colonel Capper or further suggestions, because I am not looking for work in that direction myself, and if my suggestions are of any assistance to them I shall be pleased—I think I have ideas which might be of use. I shall continue to paddle on in the other work until I get some sort of result.

Mr. THURSTON: I am glad, Sir, that my brief notes have been successful in drawing an interesting discussion. I agree with Captain Carden that the control mechanism would not come into operation until the natural speed has been exceeded, *i.e.*, its action would be late. This is, however, just what is required. The device is similar in this respect to the governor of a steam engine, which does not come into operation until a certain speed has been exceeded. Although the action of a governor is subsidiary to the speed of the engine, its action is, nevertheless, very effective. To ensure safety in a sudden gust of wind the brakes would not require to be very large. If the natural speed is 40 miles an hour, then, according to Mr. Lanchester's formula, a speed of 60 miles an hour would be quite safe. Now, the maximum gust or variation in the velocity of the wind is about 30 miles per hour. Thus, to obtain safety it would be necessary to reduce the speed from 40 + 30 = 70 miles per hour to 60 miles per hour. If the weight of the machine is 1,100 lbs. (Wright's) then it is necessary to absorb

$$\frac{W\,(v^2 - v_1^2)}{2g} = 2{,}570 \text{ foot lbs. of energy.}$$

The distance travelled in passing from the horizontal position to a cusp $= \frac{\Pi}{4} \times 3Hn$. Now Hn is given by the equation

$$V^2 = 2g\ Hn.$$

$$\therefore Hn = 53.4 \text{ feet.}$$

$$\therefore \text{Space travelled} = 126 \text{ feet.}$$

$$\therefore \text{Mean retarding force required} = \frac{2570}{126} = 20.4 \text{ lbs.}$$

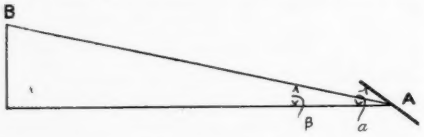
Now, according to the Eiffel Tower formula $P = .003\ V^2$

$\therefore$ Pressure per square foot at 70 miles per hour = 14.7 lbs.

$$\therefore \text{Area required} = \frac{20.4}{14.7} = 1.4 \text{ sq. ft.}$$

To allow an ample margin, say, 3 square feet, the detecting plane would only require to have an area of a few square inches. I have not made any experiments with the device beyond placing a small resistance on a model in the manner suggested by Mr. Clark. There is no doubt that the path of a glider is made much more even by this means. At the same time the gliding angle is not perceptibly increased. This damping effect depends upon the fact that the head resistance of a body varies as the square of the velocity. Therefore a resistance which is comparatively low at the natural velocity becomes an efficient brake when the velocity is increased. This principle is the same as that employed in the automatic speed control. We now come to Mr. Humphreys' discussion. The centre

of lift of an aëroplane travels forwards with a decrease in the angle of inclination. It also travels forward, I believe, to a very much smaller extent with an increase of speed. This forward travel with an increase of speed is so small that it may be safely neglected in ordinary calculations. If the angle of inclination of a flying machine or model to the horizontal is kept constant then an increase of speed above the natural velocity would give an increased lift which would cause the aëroplane to travel along an ascending path. Thus, if the inclination of the plane to the horizontal = and the inclination of the path A B = β, then the inclination of the plane relatively to the air is = $\alpha - \beta$. Thus, the angle of inclination being thereby reduced, the centre of lift travels forwards, and *vice versâ* when the natural velocity is decreased the inclination relatively to the air is increased and = $\alpha + \beta$ The centre of lift, therefore, travels backwards. This motion of the centre of lift may be counteracted in the way suggested by Mr. Humphreys by causing the automatic device either to decrease the inclination of a front auxiliary plane or to increase the inclination of a back plane. If the nose of the machine is kept down in this manner then a horizontal path can only be maintained by decreasing the inclination of the whole machine to the horizontal and thus causing an increased advance of the centre of lift. The areas and moments of the controlling planes would, therefore, require to be sufficiently large to overcome both the primary and the secondary effects. They would, therefore, require to be larger than would be necessary to control the machine in a uniform wind. As the controlling planes require a weighty structure to support them and are not active lifters under normal conditions it is clear that it is desirable to reduce their size as much as possible. This subject of mechanical automatic control, as distinguished from automatic stability, is a most interesting and fascinating one and will undoubtedly receive much attention in the near future.



There are two great methods of mechanical automatic control.

(1) Aërodynamic.
(2) Gyrostatic.

In the first case an air vane is used to control mechanism for operating the rudders or elevators and was invented by Moy in 1891. In the second case a gyroscope is used to operate a relay to control the rudders and elevators. This was invented by Sir Hiram Maxim in 1890 to 1891. The original model, made by Sir Hiram, has recently been discovered, and I hope that he will shortly publish photographs of this interesting and historic device. The famous Wright Bros. are now devoting themselves to the development of aërodynamic control. The device, which I have described, is intended as another small contribution to the great subject of automatic control. In conclusion, Sir, I would tender my thanks to the various gentlemen for their interesting discussion.

Some Lessons from Rheims

By MAJOR B. BADEN-POWELL

The great function at Rheims, the first contest of dirigible aircraft, has cleared up many points and taught us many lessons of importance. Apart from its success as a social gathering and a grand spectacle, an awakening to the world of the practicability of human flight, it has enabled those studying the science to elicit many facts hitherto difficult if not impossible to obtain.

One great point is that the speeds were carefully timed, so that we have definite and exact information of the rate of travel, often hitherto a point of some uncertainty. Heights attained were also carefully measured. But, in addition to these hard facts, an opportunity was given of judging by eye of the steadiness, certainty, ease of manipulation, etc., of the various machines. Doubtless, in future, instruments will be fitted which will record movements of pitching or rolling, variations in speed, etc., and such records should prove most interesting. Mere judgment by watching the performance from a distance indicated the following points:—

The *Antoinette* was certainly the steadiest. The machine proceeding with per-

fect regularity. The *Curtiss* was also very fairly steady and regular. The *Farman* and the *Blériot* were, perhaps, not quite so satisfactory in their general behaviour. The *Voisin* struck one as being rather cumbrous and uncertain, while the *Wright* was distinctly unsteady and continually pitching. This is, however, not the impression gained when watching Mr. Wilbur Wright himself steering the machine. It looks as though very much depended upon the pilot, although three different men, Comte de Lambert, M. Tissandier, and M. Lefébvre, handled the machines at Rheims, yet in each case they moved unsteadily, though they appeared to manœuvre and turn with more ease than other machines.

It is, unfortunately, most difficult to obtain exact details of aëroplane machines. In some instances they are not to be got—some of them have never been weighed, the engines have not been tested for exact horse-power, and so on. In others they are only given in general figures. Then, again, the weights may or may not include such items as full petrol tanks, etc. Areas may or may not include ailerons and steering planes. But, above all, the machines were, in many cases, frequently altered in detail, some of those at Rheims having new propellers and even new engines fitted during the meeting. So that, unless a great deal of trouble is taken to get at the exact figures, we must not make too certain of deductions from the figures published.

As regards speeds, it is interesting to note the difference there was in the various types. Thus we find the following recorded:—

Curtiss ..	(30 kil.)	43¾	miles per hour
	(10 kil.)	47½	,, ,,
	(20 kil.)	47	,, ,,
Bleriot (No. 22)	(10 kil.)	48	,, ,,
	(20 kil.)	46¾	,, ,,
	(10 kil.)	43	,, ,,
Antoinette ..	(30 kil.)	46¾	,, ,,
	(10 kil.)	38	,, ,,
Wright ..	(30 kil.)	39¾*	,, ,,
	(10 kil.)	42	,, ,,
	(10 kil.)	39	,, ,,
Farman ..	(180 kil.)	37	,, ,,
	(10 kil.)	32¾	,, ,,
Voisin ..	(10 kil.)	28	,, ,,
	(10 kil.)	27	,, ,,

These speeds should be compared to the surfaces and weights, which are approximately:—

	Sq. ft.	Lbs. per sq. ft.	Wt., lbs.	H.P.	
Curtiss ..	258	2·8	704	30	H. Curtiss
Bleriot (No. 22)	236	5·80	1364	50	ENV
,, (No. 21)	236	5·17	1210	40	Anzani
,, (No. 23)	150	5·20	748	25	Anzani
Antoinette ..	538	2·12	1144	50	Antoinette
Wright ..	538	1·92	1034	30	Wright
Farman ..	430	2·85	1232	50	Gnome
Voisin.. ..	538	2·28	1232	50	(various)

Thus, the actually heaviest machine made the fastest rate, yet the second in point of speed was the lightest of all. But, as might be expected, the fastest flyers were those having the smallest surface.

But even these speeds, though carefully taken, are liable in some instances to be misleading, as they are bound to depend very greatly on the wind at the moment, a puff of wind for or against only lasting a few minutes may make a very considerable difference in the records. Indeed, it is said that Bleriot, in attempting to win the Gordon-Bennett Cup, was struck by a head wind, which might easily have put him back the three seconds by which he lost the prize.

The passenger-carrying prize was of use in proving that three persons could be successfully carried round a course of over six miles, and puts an end to the arguments of those who used to say that an aëroplane was never likely to be of much use, as it could only take one man.

As regards the high flight we have not learnt very much. It has long been a question, in comparing the utility of an aëroplane with that of a dirigible balloon, as to whether the former would be able to attain the same elevation. The 500 feet reached by the Antoinette machine at Rheims, though a fine performance, has little bearing on this important question, as it is only when we get to 3,000 or 4,000 feet that a comparison can be made.

There is often more to be learnt by failures than by successes, and the cause of the many failures at Rheims is worth study. Though some of them are not at all fully explained, lessons may be learnt by the following:—

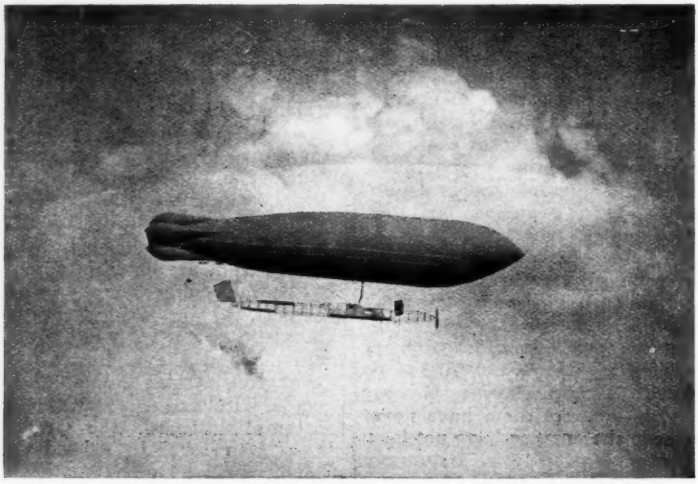
Rougier made a sudden descent among the crowd, owing to his engine stopping. It is certainly dangerous at the present

* Three different Wright machines accomplished the 30 kilometres within 3 secs. of one another's time.

** It must be noted that since this meeting the record has been considerably increased, M. Paulhan having covered 9⅜ miles in 8 minutes, or at the rate of 71 miles per hour; but it is not stated what course was taken or how much the wind favoured him.

stage ever to fly over crowds or over buildings. Motors *will* sometimes stop when least expected.

the steering apparatus. On another occasion his propeller was smashed by striking a wheat-sheaf in landing. Finally

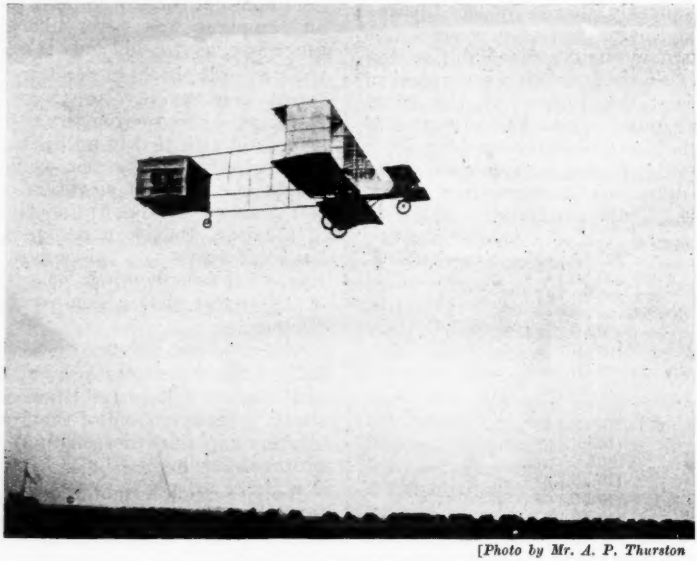


[*Photo by Mr. A. P. Thurston*

The "Colonel Renard"

Blériot, on one occasion, lost control of his machine by the steering gear

his machine caught fire, and it is important that precautions be taken against



[*Photo by Mr. A. P. Thurston*

M. Rougier's Voisin Bi-plane

getting out of order. This should be provided against, if necessary by duplicating

such a catastrophe happening again. It seemed that he made rather an abrupt

landing, which caused the connections of the petrol supply pipe to loosen and the jet of petrol in some way became ignited.

Fournier and one or two others had nasty spills through the outer corners of their planes catching in the ground. This was provided against, though, perhaps, not in the neatest way, by M. Esnault Pelterie, who applied small wheels to the tips of his wings.

Although a great deal has naturally been said about the large and varied display of successful machines, yet it is rather sad to reflect that out of the 38 machines actually entered only about 18 were able to make any show, and many of these even only made one or two short flights. As for the others, they made many attempts to rise, but proved quite incapable of accomplishing their object. It would be an interesting study to carefully enquire into the causes of these failures. But the machines are taken quietly away and nothing more is said about them!

The Fourth International Aëronautical Congress

By J. H. LEDEBOER

The Commission Permanente Internationale d'Aéronautique met in congress this year, from September 18th to 23rd, at Nancy, where the National Exhibition, devoted to the arts and industries of Eastern France, formed an appropriate setting to the most important aëronautical conference that has yet been held. Unfortunately, the aëronautical section of the Exhibition had not materialised; M. Sommer had already concluded his brilliant series of flights, and the dirigible, *Ville-de-Nancy*, which should have made ascents during the Congress, reposed in its shed *sans* envelope and *sans* motor, both of these having been sent to Paris for repairs. The fine Parc d'Aérostation consequently remained deserted, in spite of the enormous placards throughout the town that invited one to "come and see the aviation." The absence of specific attractions of this nature was, however, barely felt, owing to the efforts of the local organising committee, which arranged visits to the chief industrial establishments in the neighbourhood, in addition to the usual receptions and banquets, and to whose constant kindness and courtesy the delegates were deeply indebted for the success of the Congress. Not the least among the services it rendered was its undertaking to defray the cost of publishing the Reports of the Congress, a service that members of the Aëronautical Society will be able to appreciate at its true value.

The opening meeting of the Congress was held in the University on Saturday, September 18th, and resulted in the formation of three sections: (1) Aerostation (President, Major Paul Renard); (2) Aviation (President, S. Drzewiecki); (3) Legislation (President, Colonel Hirschauer. Owing to the amount of work before the Congress these sections, unfortunately, were compelled to sit simultaneously during the ensuing days, which rendered it impossible personally to follow the work accomplished by each separate section in its entirety, though it was always feasible—by means of judicious selection—to attend the more important discussions.

Among those who took a prominent share in the work of the Congress were: The President, M. Ch. Ed. Guillaume, Director of the International Bureau of Weights and Measures; Colonel Hirschauer, Commander of the Aëronautical Establishment at Meudon; the Russian delegates, Colonel Naidionoff, representing the Ministry of War, and Professor de Metz, of Kieff University, representing the Ministry of the Interior; Lieutenant Foulois, delegated by the United States Army; Majors Paul Renard, Bouttieaux and Voyer; Dr. Max Gasser, of the Technical College of Darmstadt; Capt. Castagneris; Professor Bronislawski; Chevalier de Clément de St. Marcq; MM. Drzewiecki, Soreau, de la Barre, Bréguet, Lecornu, de la Hault; Lieut. Glorieux, of the French Navy.

The following were among the papers read:—

"The Manufacture of Hydrogen," by Lieut.-Col. Espitallier.

"Aëronautical Maps and Cartography," by Dr. Gasser, Lieut.-Col. Moedebeck, and J. Saunière.

"Topography by Means of Photographs from Balloons," by Capt. Sacconey.

"Dirigible Balloons," by Major Bouttieaux and Voyer.

"Meteorology and Weather Forecasts," by Teisserenc de Bort and Prof. Brunhès.

"Screw Propellers," by S. Drzewiecki and Bréguet.

"Aërodynamical Laboratories," by Major Renard and S. Drzewiecki.

"Aërodynamics," by M. Soreau and Prof. Bronislawski.

"History of the Aëroplane," by J. Armengaud.

"Light Motors," by M. Lumet.

"Aëronautical Terminology," by Major Renard.

"Aërial Traffic and International Law," by M. du Laurens de la Barre and E. d'Hooghe.

"Aërial Traffic Regulations," by Lieut. Glorieux.

The foregoing list, extensive though it be, can only convey a most inadequate impression of the actual work accomplished, the most valuable part of which —as is usually the case—resided in the discussions aroused by these papers and by the resolutions brought before the Congress.

In the restricted space at my disposal I must necessarily confine myself to giving the merest outline of these discussions, some of which, nevertheless, were of sufficient importance to deserve a lengthy detailed report.

Dr. Gasser's paper on "Aëronautical Cartography" raised, perhaps, the most interesting subject discussed by the section on Aerostation. Since the year 1906 Dr. Gasser has been engaged in preparing a series of maps of the German Empire for the use, primarily, of Count Zeppelin, whose advice he has largely followed. According to him the most essential quality that an aëronautical map should possess is the exact and clear indication of every variation in the level of the country; the main differences in height are indicated by a different colour for every 100 metres, special attention having been paid, in selecting the colours, to rendering them as readily distinguishable by night as by day; in addition all intermediate variations in level of 20 metres are marked by a system of signs; a further system of signs shows a sharp rise in the ground, church towers and steeples with their different shapes, tall buildings and electric wires. Streams, marshy or wooded ground are indicated with the greatest care as being susceptible of influencing the static equilibrium of the airship. The scale is 1 : 200,000, or, roughly, 3 miles to the inch.

In the Aviation Section a long discussion centred round the question of the establishment of Aërodynamical Laboratories raised by Major Renard and M. Drzewiecki. Great stress was laid on the absolute importance of scientific experiment at the present stage of development of aviation. The main points brought out by the discussion may fairly be stated as follows:—The laboratory must be stationary, *i.e.*, the experiments must be carried out in an artificially-produced current of air whose velocity may be varied at will from 10 to 80 ft. per sec., and which must possess absolute uniformity of flow. The wind-tunnel must have a relatively large diameter so as to allow of the objects being tested at a certain distance from the tunnel walls whose proximity invariably sets up some irregularity in the flow of the air. The chief difficulty, in fact, consists in obtaining an air current of uniform flow and velocity. Major Renard, Capt. Castagneris, and M. Drzewiecki explained the various methods that have been adopted, with varying success, in different laboratories in the attempt to obtain this uniformity of flow. Capt. Castagneris further described a series of experiments that have been carried out at Rome to determine the resistance of various bodies. The body to be tested consists of a hollow shell through whose surface minute holes have been bored; with the aid of a differential manometer placed in the interior it is possible to determine with absolute precision the differences in the pressure on various bodies and on the different parts of the same body. This method has proved of special value in experiments with the hulls of dirigibles and aëroplane surfaces.

But the most important work of all was accomplished in the third section. On the proposal of MM. Guillaume, Hirschauer, and Renard it was resolved to draw up and adopt a uniform international terminology and system of notation for aëronautics. At the present time almost every writer employs different algebraic symbols for the same qualities and functions, and almost every constructor follows a different method in

calculating or indicating the dimensions and other qualities of his machine; this lack of uniformity constantly creates confusion and forms a serious, but wholly unnecessary, obstacle to the progress of aëronautics. The "unification" of aëronautical science which is now proposed should have the same excellent effect as the similar work accomplished by the International Electrical Conference of 1880. In his note on terminology Major Renard proposed to retain the following terms:—"Aëronautics," to denote the entire science of aërial navigation; with "Aërostation" and "Aviation" for its "lighter" and "heavier-than-air" subdivisions. Of the terms "Aëronat" and "Aëronef" adopted by the Congress of 1889 to denote a dirigible and a flying machine respectively, he proposed to abandon the former and to retain the latter, but in the new signification of any kind of automobile aërial craft. "Aërostat" and "Dirigible" are universally employed and must be retained, but a new generic term must be found for the dynamic flying machine; Major Renard's proposal of "Avion" is, however, hardly likely to meet with approval.

I have left until the last the important questions included under the heading "Aërial Traffic Regulations and International Law." Restrictions of space forbid me to enter into the long discussions that were held on these subjects or to record the conflicting views to which they gave rise. The resolution finally adopted after very careful consideration runs as follows:—

"The Fourth International Aëronautical Congress calls upon the Governments of the nations to refrain from prohibitive measures, and to come to an agreement to regulate aërial traffic while affording it the greatest possible measure of freedom; at the same time safeguarding their national security by such measures of inspection as may be deemed necessary and ensuring compliance with their fiscal laws in an adequate manner, such as that employed with regard to motor-car traffic. The Congress recognises that the registration of aërostats and aëronefs would form the best and, perhaps, the only method of rendering an unrestrictive system of regulations effective."

A word of explanation may be permitted. Early this year the French Government, in deference to popular clamour, imposed prohibitive Customs duties on foreign balloons landing in France, with the avowed object of stopping the increasing number of ascents during the course of which foreign balloons passed over important fortifications. Reprisals were, naturally, threatened, and the free development of aërial navigation was in danger. The whole question presents grave difficulties from an international point of view. M. du Laurens de la Barre, in his paper, made it clear that the difficulties resolved themselves into three questions: Espionage, Customs, and sanitary regulations. The third question need not yet be considered; the first can be satisfactorily settled; the only thorny question is that relating to Customs. There is only one method of preserving the free circulation of aërial traffic while preventing any infringement of the Customs duties and other regulations—a method as simple as it is effective. This is the compulsory registration by each country of every balloon, dirigible, and flying machine. Everyone of these would have to carry its papers, and by this twofold expedient every vessel could be readily and unerringly identified and offenders punished.

It may be added that these proposals meet with the approval of the French Government by whom they will be advocated at the official International Conference that will be attended by the other Powers in Paris early next year.

It is, however, obvious that freedom of aërial circulation is only compatible with the establishment and observance of a code of international traffic regulations. Lieut. Glorieux, of the French Navy, in a paper read before the Congress, advocated the application to aërial traffic of the international regulations that are universally in force with regard to maritime navigation. The effect of this proposal, in brief, is to approximate the ordinary balloon to the sailing ship and to place aëronefs in the position of steam vessels upon whom primarily devolves the duty of avoiding collisions according to the rules in force.

There only remained one matter to be considered—the constitution of the C.P.I.A. itself. In view of the growing activity of that body and the increasing importance of its work it was resolved to meet every year in future instead of every other year as hitherto. In addition, the

central committee will appoint a corresponding member for each country for the purpose of keeping in touch more closely than before with the development of aëronautical science throughout the world. The question of establishing a permanent central institute and constructing a large international aërodynamical laboratory, raised by Chevalier Pesce, was thought to be premature, and met with little approval.

The Congress closed on Thursday, September 23, with a balloon race which started from the Parc de la Pépinière in the centre of the town. Next year's meeting will be held during the month of September, most probably in Brussels.

The National Airship

By ERIC STUART BRUCE, M.A. Oxon. (Honorary Secretary Test Committee, National Airship Fund)

On July 21st last an announcement was published in the columns of the *Morning Post* which caused no small thrill of pleasure in the patriotic heart. It was one which freed the British nation from the reproach that it was lamentably in the rear of other nations in military airship equipment, for it told the welcome news that through the enterprise of the *Morning Post* an airship had been ordered for presentation to the British Government. It was the class of airship that had been ordered that gave such general satisfaction. It was to be no mere temporary expedient of scant engineering quality, but, to quote a French saying, "a ballon sérieux," an airship of which the nation could feel proud, one which promised to be the finest, most practical, and most powerful yet constructed. Through the vigorous action of the above-mentioned journal the nation had made one bound from sluggish apathy to prominent accomplishment in airship development.

When the great Lebaudy airship now being constructed at Moisson has been presented to the nation some may be inclined to say it is a French airship after all, and what credit is this to the British nation? Very much credit will, without doubt, accrue to the French aëronautical skill, but for the production of this airship the British nation must take some credit too. The stringent, thorough, and well-considered conditions the British War Office has laid down for the national airship to fulfil, before it can be accepted, have not only stimulated the building of this powerful airship, but already raised the standard of airship construction throughout the world.

In connection with the National Airship it was my privilege to be asked to visit Paris to make a thorough investigation into French airship construction, report and advise thereon. This examination showed that no airship yet constructed in France would be capable of fulfilling the stringent conditions the British Government had imposed. Even the latest type constructed for the French Government by Messrs. Lebaudy, "La Liberté," had only a single motor of 120-H.P. When the Government conditions were first placed into my hands and I was asked to make another visit to the French capital to ascertain if the French makers could extend their previous achievements so far as to carry them out, I felt no small misgivings lest my mission might be in vain.

These conditions which had the approval of the Advisory Committee of the National Airship Fund, consisting of Earl Roberts, Viscount Milner, Lord Charles Beresford, Mr. E. P. Frost, President of the Aëronautical Society of Great Britain, Mr. W. Wallace, K.C., Chairman of the Aëro Club of the United Kingdom, and Colonel H. S. Massy, C.B., President of the Aërial League of the British Empire, have already been published in full. Amongst these are the following tests:—The airship will have to remain in the open for 24 hours with winds up to 20 miles an hour. It will be tested as to the leakage of the balloon envelope contents, not more than a hundredth part of which may be lost for every day of 24 hours. It will have to rise to a height of 6,000 feet with a crew of six men and wireless telegraphy apparatus, and then have in hand force sufficient for three hours' run at full speed, together with one-fifth of the original complement of ballast.

It will also have to complete a triangular course of 100 miles each side in not more than 14 hours, travelling fully equipped, and also have to travel a measured course of five miles with and

against the wind at not less than 32 statute miles an hour. It was obvious that these conditions could not be carried out unless the new airship should have a very much larger cubic capacity than those previously made in France and be equipped with very much more powerful motors.

One sign of genius is its power of rising to occasion. M. Julliot, the engineer of the Lebaudy firm, who had designed the first Lebaudy airship and who had in each successive airship striven to ensure all improvement that experience could suggest, is not of that temperament that could let a new opportunity of progress slip. M. Julliot, with alacrity, prepared a scheme which, in his opinion, would fulfil the most severe tests a Government has ever imposed upon a vessel of the air. The National Airship will be of some 8,000 cubic metres gas capacity, no less than 328 feet long, and have two engines of 135-H.P. each. These can be used either independently or together at will.

But besides thus stimulating progress of construction by boldly stating what an airship should be capable of doing if it is to be of real use in war, the British nation will also have had a share in the actual manufacture of the new airship. The cloth used for the envelope is to be provided by a firm of British name. Another concession was that British motor makers could tender for the motors.

The whole undertaking is a pleasing example of the entente cordiale, a striking proof of the scientific value of Internationalism.

There were many reasons for placing the order for the National Airship with the firm of Messrs. Lebaudy. Perhaps the foremost of these was the knowledge that of all firms who had made airships that one had the greatest experience. The factory at Moisson has, in fact, turned out no less than five airships. four for the French Government—(1) "Le Lebaudy," (2) "La Patrie," (3) "La République," and (4) "La Liberté." One for Russia—"La Russie." If the rebuilding of the original Lebaudy is counted, we can say six. Another is to be made for Austria. No less than some 188 voyages have been made with these airships with small percentage of mishap.

Then the Lebaudy type contains a great many important engineering features. The airship is semi-rigid. The necessary rigidity is well secured by the girder-built elliptical platform of stout canvas stretched over a steel framework strengthened by intercrossing steel tubes and wires. This is fastened immediately beneath the balloon. This platform helps to preserve the equilibrium and prevents rolling and pitching. As was pointed out to the writer by M. Julliot, another advantage of this elliptical platform, or, as it is called in French, "carcasse," is that by its use effective mooring of the airship is secured, as the cables can be fastened to the rigid portion of the platform. This claim has been very fully borne out by actual experience. The Lebaudy was recently camped out in the open at Chalais-Meudon without injury for seventeen days and nights. It had no protection of any kind, was exposed to varying temperatures, rain, and winds of even tempestuous force.

The manufacture of the dissymmetrical envelope is a notable feature of this system.

It is made of waterproofed canvas composed of two layers of cotton tissue held together by a layer of vulcanised india-rubber.

The inner side of the envelope, which is exposed to the action of the gas, is protected by a coating of india-rubber, while the outer surface is protected against the action of the light by a coating of bichromate of lead. This gives the envelope its remarkable yellow colour. The construction of the car is unique. It is shaped like a boat having a flat bottom. The frame is of steel covered with thin sheets of aluminium. The two screws are placed on either side of the car.

The arrangements to ensure stability are most advanced in the Lebaudy type, and these in themselves form patent rights in various countries. They consist of large planes at the bow and stern, and vertical and horizontal fins at the stern. There are horizontal and vertical rudders.

An improvement added to the Lebaudy airship in 1904 was the pyramid arrangement of steel tubes at the lowermost portion for landing without a shock.

There are still a few in this country,

and amongst them even military men, who belittle the value of the navigable balloon in war. Recent trials with "La République" and "La Liberté" in France, each so inferior in motive power to the airship ordered for this country, should go far to dissipate the last remnants of that prejudice which has obscured usefulness and hampered progress.

Taking part in the military manœuvres in the Bourbonnais, "La République" rose to a height of 700 metres and remained in the air two hours, in that time travelling 50 miles. The officer in the balloon, whose duty was to discover the enemy's positions, was able to clearly see each one and even calculate the number of troops. In the absence of wireless telegraphy apparatus, which the British airship will carry, the written information was thrown down in a sack of ballast when the balloon came over the spot where there were friendly forces.*

On the next day "La Liberté" made no unworthy flight. It left its shed at Moisson at 6 a.m. and descended at 11.25. In that time with its 120-H.P. engine it had covered a distance of 160 miles without loss of ballast.

In connection with the National Airship it would be difficult indeed to bestow too much praise on the action of the *Morning Post*. Those few who classed its work with newspaper advertisement soon had to change their opinions as unworthy of a great and noble undertaking; for as time went on it was apparent to all that the object of the *Morning Post* was to stimulate patriotism, and as no one else had given the nation an adequate airship, to present it with the fittest and most perfect type that could be found.

If one hundred years hence the *Morning Post* should have recourse to a picturesque custom, and from time to time quote from paragraphs of 100 years ago, it may with no little pride call to life again the paragraph of July 21st, 1909, which told that it had founded the British Aërial Fleet, and thereby laid up for the years to come a nation's gratitude and respect.

* Since the above article was written the fatal disaster to "La République" has occurred owing to the breakage of a steel propeller. This has raised much discussion as to the safest material for the construction of aërial propellers. In the National Airship the propellers will be made of wood.

The Paris Aëronautical Exhibition

By HERBERT F. LLOYD

L'Exposition Internationale de Locomotion Aérienne (held at the Grand Palais, Champs Élysées, Paris, from October 3-17, 1909) marks a great advance on the previous exhibition of last December, and affords a striking illustration of recent progress in aëronautical design and manufacture. More than 25 full-sized French-made aëroplanes are on view, and almost all the space is devoted to heavier-than-air machines, light aërial motors, propellers, and accessories, while displayed in the side galleries is a large variety of models and aëronautical toys.

In the great hall are hung Comte de la Vaulx's dirigible "Zodiac," several modern spherical balloons, also a scale reproduction of the original Montgolfier. In the centre is suspended a replica of one of the balloons used in the siege of Paris, and below it, banked with flowers, reposes the famous travel-stained Blériot XI. cross-Channel monoplane; the four stands of honour round it are occupied by Wright, Antoinette, Voisin, and Blériot machines.

The following description deals briefly with some of the special features and methods of operation of several of the more important exhibits. A list of the various machines with general particulars of sizes and weights, etc., is given on page 112.

[*Note.*—The h.p. stated below is French; 1 cheval de force = .986 English h.p.]

MONOPLANES

Bleriot —Two machines of the latest No. XI. type are shown. These differ in some of the details from the original No. XI. The two-bladed Chauvière propeller, 2m. 08 diam. (weight 6 kilos.) is slightly narrower in the width of the blades; the bays of the quadrilateral frame have an altered spacing, with two short bays (about 8 in. and 9 in. centres) at the extreme front; the width of frame is tapered very gradually to the last bay, where it suddenly finishes to a point; the main surfaces are of decreased camber and lighter construction, and the thick-

THE PARIS AËRONAUTICAL EXHIBITION. GENERAL VIEW

ness increases very rapidly from the front edge; they are built up with uniform ribs at about 12 in. centres on 5 light booms, instead of on 3 booms with ribs of varying thickness at about 4½ in. centres, as in the Channel flyer. The elevating planes and rear vertical rudder are of slightly different shape; the petrol tank is larger; the seat is more comfortable, and has a chair back instead of a leather strap across the frame; the bell-shaped aluminium control is flatter, and has a wood hand-wheel mounted on the top. In these machines no wire strainers are used in staying the frame; the steel shackles which take the wires also serve to strain them to the required tension. The fore and aft movement of control lever operates rear elevating planes, and the same lever when moved sideways effects the warping of the main surfaces. The vertical rudder in rear is worked by a foot-yoke in front of the control lever. The 25-30-h.p. air-cooled Anzani engine has 3 cylinders 105mm. bore and 130mm. stroke, and revolves at 1,600 r.p.m, The weight of this motor, complete, but without fly-wheel, is 65 kilos.

The Blériot No. XII. is somewhat similar in design to the No. XI. type, and the main surfaces are built up in the same manner. The frame is much larger and the pilot's position is within the frame below the main surfaces and just behind of the 8-cylinder 60-h.p. water-cooled E.N.V. motor, which drives a 4-bladed Chauvière propeller through an overhead chain. The single elevating plane in rear is below the fixed horizontal back plane, and the rear vertical rudder is pivoted behind the long vertical fin which extends along the top of the frame. The control is the same as in the No. XI. type. This machine has carried two passengers as well as the pilot.

Antoinette.—The machine exhibited by this firm is fitted with a 100-h.p. Antoinette motor. It has not yet undergone its trials, but is expected to attain a speed of 70 miles per hour. A standard Antoinette monoplane with 50-h.p. motor is shown by the Compagnie Aérienne; this is the type of machine so successfully piloted by Latham; the frame consists of a boat-shaped body of spruce in the form of a triangular hull with sharp stem in front; the main surfaces are a fine example of built-up girder work, and are of considerable thickness towards the centre; the weight of these surfaces (without fabric) is about 1 kilo. per sq. m.; they are strutted with vertical masts passing through the surfaces, and stayed with wire above and below. The position of the weight of the motor well in front, and that of the pilot some distance in rear of the main surfaces, would appear to result in a high moment of inertia, though in flight this type of machine seems to possess remarkable steadiness.

The directing surfaces in rear are very small compared with the area of the main surfaces, but have a powerful effect owing to their great distance from the centre of gravity of the whole machine; the special camber of the wings also seems to conduce to its longitudinal stability. The suspension is by means of a compressed air cylinder mounted on a triangular frame, which is carried on two small wheels 1m. 50 apart; the tail of the machine rests on a small skid fixed to the frame. Underneath the front of the body and projecting forward is a heavy oak runner whose function is to protect the propeller from any risk of injury in landing.

The propeller has two aluminium blades rivetted to nickel-steel forged arms. The body is covered with cedar-wood in front and in the rear with fabric. The pilot's seat has a round back, and is well cushioned, and is provided with a padded fixed bar in front to prevent him from being thrown forward in the event of a rough descent.

A large hand-wheel on left side of pilot warps main surfaces, and a similar wheel on right-hand side operates the rear horizontal rudder. The vertical rear rudder is worked by a footyoke. In front of the pilot are two small hand-wheels, the left-hand one controls ignition advance, and the right-hand one the induction pipe to motor cylinders.

On each side, forming part of the hull, are the radiators; each section is 4m. long by 40cm. wide, and is composed of small aluminium tubes; the weight of the radiator is about 12 kilos.

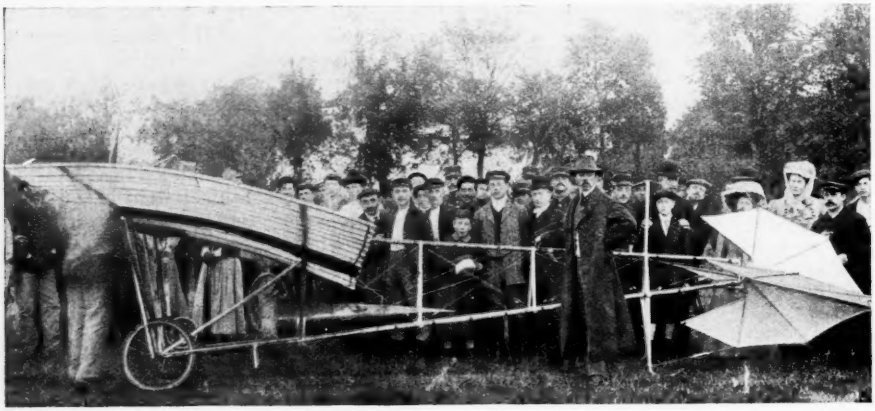
The 50-h.p. Antoinette motor has 8 cylinders, 110mm. bore by 105mm. stroke, and weighs 90 kilos. complete.

The Antoinette machines are made

by skilled boat-builders, and are certainly the most perfectly finished machines at this exhibition.

R.E.P.—The bird-shaped body of this machine is constructed of steel tubing with autogenous welded joints. No wood is used except in main surfaces, which are built up of ribs mounted on wood booms reinforced with steel ribbon. The surfaces and body are covered with red Continental fabric. In this latest pattern of machine the horizontal tail plane is not movable; there is a vertical rudder in rear, and a long fixed vertical fin on top of the frame. The suspension in front is on one wheel below body; it drives direct a 4-bladed aluminium propeller 1 m. 80 diam. at 1,500 r.p.m.; the average efficiency of this propeller is stated to be 80 per cent.; the normal speed of the machine is about 70 kilom. per hour; the alternative size of R.E.P. motor develops 20-25-h.p. at 1,500 r.p.m.; it has 5 air-cooled cylinders and weighs 70 kilos. complete.

Santos Dumont 20.—This little machine, the smallest, cheapest, and fastest yet constructed, forms the centre of attraction to most of the visitors to this exhibition. The design and workmanship are most ingenious. The triangular body is built up of three large bam-



M. Santos Dumont and his Monoplane "Demoiselle" at St. Cyr

frame, mounted on an oleo pneumatic braking device; a small wheel carries the tail, and the wing tips are provided with light wheels and skids. The area of the main surfaces only is about 20 sq. m., and the load is about 20 kilos. per sq. m.

The pilot is seated in the chassis about the middle of the main surfaces. The left-hand lever is mounted on a universal joint—lateral movement warps main surfaces. Fore and aft movement alters the angle of attack of the main surfaces, and is the equivalent of a rudder in the horizontal plane. The right-hand lever operates vertical rudder in rear. A pedal worked by the right foot controls the motor speed.

The 30-35-h.p. air-cooled 7-cylinder R.E.P. motor weighs 88 kilos. complete, and is fixed on the extreme front of boos, one above and two below, with oval steel struts stayed by thin piano wires; these wires are tightened by means of small, neat strainers about 1 in. long, consisting of a frame with small reel on which the slack of the wire is wound. The main surfaces are rectangular in plan, cut away in front to clear propeller. Each wing is built up of two main booms tapered towards the ends, bamboo ribs, spaced at about 8 in. centres, and bamboo corner pieces; they are double surfaced, covered with Japanese silk, and are wire-edged at front and back; the front edge is sewn to the wire and the back edge is laced. There are stay wires and warping cables beneath the main surfaces, but no wires above. The bamboo frame is provided with brass socket joints in rear of main surfaces to facili-

tate transport. The horizontal and vertical directing surfaces are mounted on a universal joint at rear end of the frame, and are formed of bamboo ribs on which the fabric is stretched; these surfaces are flat and have no camber.

The frame is carried on two small wheels in front and the back rests on a small steel skid in rear; this skid also projects above the frame and forms a lead for the wires controlling elevator. The 25-30-h.p. Darracq motor, with two horizontal opposed water-cooled cylinders, is mounted at the front of the main surfaces, being supported on the top bamboo and also on the front transverse booms. It can develop 30-h.p. at 1,350 r.p.m., or 32-h.p. at 1,480 r.p.m.; the bore is 130mm., and the stroke 120mm. The weight, complete with carburettor, etc., but without fly-wheel, is 52 kilos. The cylinders have brass water-jackets and auxiliary exhaust holes; the radiator is composed of small copper tubes about ½-in. diam., and is duplicated, one section forming part of the under surface of each wing.

The 2m. diam. integral propeller is of Chauvière make, and the boss is tapered in front to a sharp point.

The pilot's seat is beneath the main surfaces, and consists of a thin leather band fastened to the two bottom members of the frame; his feet rest in a steel stirrup, which also constitutes a motor-speed control pedal. The right-hand lever operates rear elevator and is also fitted with an ignition switch; on the pilot's left is a small hand-wheel with a wire cable which works the rear vertical rudder. The wings are warped (independently) by means of an inclined lever which the pilot leans against and operates by the movement of his back.

The brass petrol tank is of stream-line form, and is fixed above the main surfaces.

M. Santos-Dumont only weighs 50 kilos.; for pilots of a heavier build MM. Clément Bayard are augmenting the area of the main surfaces by increasing the span from 5m. 50 to 6m. 50.

M. Santos-Dumont has offered to the public any rights he may possess in the design of this machine; after the conclusion of the exhibition it will be on view at the Office de l'Aviation, 3, Avenue de l'Opéra, Paris.

The speed of the No. 20 machine is about 87 kilom. per hour.

BIPLANES

Wright —M. Paul Tissandier's French made machine is shown by the Sie. Astra. Another similar machine is on the Ariel Co.'s stand. This follows the original Wright design in most particulars; the framework and struts are made of American spruce, and all the woodwork is coated with aluminium paint. The main plants are double surfaced, and the elevator planes single surfaced, with ribs sewn in pockets. The continuation pieces carrying elevator are joined direct to main skids, without any intervening bent elm connecting-pieces.

The motor used is a 25-h.p. 4-cylinder water-cooled Wright engine, made by Barriquand et Marre.

The historic machine on which the Wright Bros. made the first mechanical flight at Kitty Hawk in 1903, and which Wilbur Wright used at Le Mans and Camp d'Auvours in 1908, is on view in one of the galleries.

Voisin —This machine is of their standard pattern with 4 side panels between main planes and the usual box tail in rear; the struts are cross-stayed beneath the surfaces. The planes are single-surfaced with booms and ribs in pockets.

The motor is a 50-h.p. Antoinette driving direct one of the ordinary Voisin propellers with steel blades riveted on steel arms and of variable pitch. It is stated that their new type of machine is to have the motor in front with tractor screws and that the front elevator is to be placed inside the tail.

Farman —This machine is of modified Voisin pattern and is similar to the machine with which Farman created a world's record at Rheims for duration and length of flight; it has carried two passengers in addition to the pilot; the main and tail surfaces are built up after the Voisin manner, but without side panels, and are provided with ailerons controlled by lateral movement of a lever on pilot's right hand; the same lever with fore and aft movement operates the front monoplane elevator; the rear duplex vertical rudder is worked by a foot-yoke. The pilot's seat is on front of bottom plane and the suspension in front

is on two sets of two small wheels, each set being carried by thick rubber cushion coils on a long central skid connected to the main frame.

There are two smaller wheels in rear beneath the tail.

All the struts are sharp edged fore and aft.

The most interesting feature of this machine is the 50-h.p. Gnome 7-cylinder air-cooled motor, which weighs 76 kilos. complete; the bore and stroke are 110mm. and 120mm. and the speed is 1,200 r.p.m. The cylinders, pistons, cranks, and crank chamber, etc., are machined from solid nickel steel hand forgings, and are mounted on the fixed crank shaft, round which they revolve with propeller, thus forming their own flywheel and ensuring thorough cooling; the pistons are cut away on one side so as to clear each adjacent piston at bottom of the stroke, and are fitted with automatic inlet valves. The fixed shaft is hollow and forms an induction pipe from carburettor, which is mounted upon the front end; it also acts as a conduit for the lubrication pipes leading to crank chamber. The exhaust valves in cylinder heads are fitted with flat instead of spiral steel springs.

The speed may be varied from 200 to 1,300 r.p.m. and the consumption of petrol is stated to be about 300 to 350 grammes per H.P. hour and of oil about two litres per hour.

The Gnome Co. also make a 14-cylinder engine of similar type which weighs only 100 kilos. and develops 100-h.p. at 1,200 r.p.m.

REMARKS

Design —The majority of machines are of the monoplane type, and have tractor screws with rear directing and stabilising surfaces. All the biplanes have a horizontal front rudder, and a stabiliser tail with vertical rudder in rear. The main surfaces are, in most cases, flexible, and have some warping device, or are provided with ailerons; in some types the angle of incidence of the main surfaces can also be varied.

Motors —The tendency seems to be towards lower powers and increased simplicity of parts, and more attention is being paid to reliability and economy.

Propellers —Almost all the propellers are of the two-bladed integral type, built up of thin walnut planes glued together under pressure; they are usually of small pitch and are direct coupled. The machines fitted with metal propellers are the Antoinette, Voisin, and R.E.P.

The only English firms exhibiting are Messrs. T. W. K. Clarke and Co., the Green Engine Co., and the Wolseley Motor Co.

PARIS AËRONAUTICAL EXHIBITION, 1909

Machine	Type	Constructed by	Number of Propellers	Total Surface	Dimensions		Builders of Motor	No. of Cylinders	Power	Weight of Machine, complete (with Petrol but without Pilot)
					Length	Span				
				sq. met.	metres.	metres.			H.P.	kilos.
Antoinette ..	Monoplane	Sté. Antoinette	1	35	12	14	Sté. Antoinette ..	8	50	475
A. V. I. A. ..	,,	Atelier Vosgiens	1	14	7	7·50	Dutheil & Chalmers	2	20/25	200
Blériot XI. ..	,,	Etabliss. Blériot	1	14	7·50	8·50	Anzani	3	25	230
Blériot XII. ..	,,	Etabliss. Blériot	1	27	7·60	9·60	E. N. V.	8	60	450
Chauvière ..	Biplane ..	Lenteado ..	1	20	6·50	10	R. E. P.	5	20/25	140
Clément-Bayard	,,	Clément-Bayard	1	60	11·65	12	Clément-Bayard	4	43	450
Farman ..	,,	H. Farman ..	1	40	12	10	Gnome	7	50	450
Grégoire-Gyp..	Monoplane	L. J. Grégoire	1	22	11	10	L. J. Grégoire ..	4	40	300
Hanriot II. ..	,,	Hanriot ..	1	24	9·60	9·17	Buchet	6	50	400
Kœchlin ..	,,	Kœchlin ..	1	18	7·50	8	L. J. Grégoire ..	4	24	260
R. E. P. ..	,,	R. E. P. ..	1	21	8·50	10·80	R. E. P.	7	35	380
Santos-Dumont	,,	Clément-Bayard	1	11	6·20	5·50	Darracq	2	25/30	110
Vendôme ..	,,	Vendôme et Cie.	1	22	11	11	Anzani	2	30	270
Voisin	Biplane ..	Voisin Frères ..	1	50	12	11·50	Antoinette ..	8	50	500
W. L. D. ..	Monoplane	Lioré et Cie. ..	2	20	8·70	8·70	Buchet	4	35	300
Wright ..	Biplane ..	Sté. Ariel ..	2	48	8·50	12·50	Barriquand & Marre	4	25	400

NOTES

The Disasters in France.—The recent series of fatal accidents in France, which has aroused the whole world's sympathy is all the more deplorable because it carries no new lesson. In the case of M. Lefébvre, the cause of the accident will never be known, though it is possible that the forward control may have developed some structural defect. Captain Ferber's death was due to a mishap of the simplest nature, and the *République* was wrecked by a broken propeller blade, which might have flown in any direction but the one it took without causing injury. But these men have not died in vain. They pledge us the more deeply to our task, and by fresh victories to avenge them and to raise them monuments.

Eugéne Lefébvre was born on October 4, 1878, and took up flying only this year. He speedily proved himself a master of the Wright machine, and his handling of it was one of the features of the late Rheims meeting.

On September 7, he was trying some new Wright machines for the Ariel Company at Juvisy, when from some unexplained cause the machine he was driving fell to the ground from a height of about 20 feet, and was completely smashed. Lefébvre, thrown violently out of his seat, died ten minutes later.

Captain Ferdinand Ferber was born at Lyon on February 8, 1862, and received his captaincy in the Artillery in 1893. His first gliding experiments were made in 1898, and from that time until his death he devoted himself to aëronautical science, becoming one of the highest authorities on the subject.

In 1905 he published a series of articles in the *Revue d'Artillerie*, on "Les Progrès de l'Aviation par le Vol Plané," which have become famous; and he subsequently wrote many valuable articles and some books on the subject, including "Les Calculs," and "L'Aviation, ses débuts et son développement," and presented several papers to the Académie des Sciences.

[*By courtesy of "Aeronautics"*

The late Captain F. Ferber

In practical work he invented and flew with a machine of the biplane type, which performed very well at Issy last year. This was later on abandoned for a Voisin machine, which he raced very successfully at Juvisy in June last, and in August at the Rheims meeting.

In September Captain Ferber, under the pseudonym of "De Rue," was flying at

Boulogne; and on the 22nd of that month he was killed while running along the ground in alighting after a flight. The front wheels of the machine sank into a ditch at the same moment as a corner of the lower plane fouled a hillock, with the result that Captain Ferber was thrown out, and pinned beneath the whole weight of the motor. Though he extricated himself before assistance arrived, he collapsed shortly afterwards, dying within half-an-hour of the accident.

Soldier, scientist, mathematician, and aëroplane pilot, Captain Ferber is a most remarkable figure in the history of aviation, and has well earned the immortality, which will assuredly be his, as one, and not the least, of the pioneers.

It was only three days after Captain Ferber's death that a terrible fate overtook the military dirigible *République*, plunging France for the third time within the month into the deepest grief. On September 25, the *République* was returning from manœuvres at La Palisse to its base at Meudon, when, while passing Moulins, one of the right-hand steel propeller blades broke off at the boss and flying upwards tore the envelope, which immediately ripped right across under the pressure of the escaping gas. The dirigible dropped like a stone from the height of about 300 feet, and the crew of four—Captain Marchal, Lieutenant Chauré, and two mechanics, Adjudants Réau and Vincenot—were killed outright. The *République* was constructed in the spring of 1908 by MM. Lebaudy, and had a capacity of 130,700 c. ft. Its length was 200 ft.; greatest diameter 35.5 ft.; total weight 6,150 lbs.; lifting power (total) 8,910 lbs.

The Late Herr Professor Georg Wellner—The death of Professor Wellner on September 7, at Velden, Carinthia, removes one of the pillars of aëronautical science. Georg Wellner was born at Prague in 1846, and in 1876 became Professor of Mechanical Engineering at Brünn, where he remained until three years ago. He was a strong believer in the hélicoptere, and his researches and experiments have certainly carried the problem of flight by this means considerably nearer solution. A voluminous writer, he was the author of a great many valuable papers and several books, including "Der Dynamische Flug" (1899), and "Der Flugmaschinen"—a record of thirty years' work—which has only recently appeared.

An Aeronautical Society for Canada—Through the efforts of Mr. M. B. Logan, a member of the Aëronautical Society of Great Britain, an Aëronautical Society of Canada is in process of formation at Toronto. Encouraging communications have been received from Lord Strathcona and Earl Grey, and Dr. Graham Bell has promised his assistance. Mr. Logan is acting as Secretary *pro tem.*; his address is 99, Gloucester Street, Toronto, Ont. We congratulate Mr. Logan on his enterprise, and wish the new Society the greatest success.

The "Model Engineer" Exhibition—This exhibition, which is being held at the Horticultural Hall, Westminster, from October 15 to 23, was opened, as we go to press, by Sir Hiram Maxim. Sir Hiram, who expressed himself surprised at the large amount of beautiful work in the exhibition, was presented with a small model in silver of his 1894 flying machine.

The exhibit of model aëroplanes—some sixty in all—is an exceedingly fine one, and shows an extraordinary advance on the show at the Agricultural Hall two years ago. It may be said that as a whole, there are no eccentricities, and that every working model shown is capable of a degree of flight. On the other hand, very nearly all the machines are based on some well-known type of flyer, the most popular being the Blériot, with the Wright and Voisin following in the order named. There are also a very neat model of the Herring-Curtiss, a modified Antoinette, and an ingenious bi-plane with mica surfaces. The workmanship is generally extremely good; a Blériot model in aluminium, and a large Twining-type model in wood, are very noticeable in this respect, with their graceful lines and clean finish. We congratulate our contemporary on a most interesting exhibition.

REVIEWS

"Aerial Navigation of To-day," by Charles C. Turner (London: Seely and Co., Ltd., 1910; pp. 327; 70 illustrations and diagrams; 5s. net).—It is a curious fact that in the half-century that has elapsed since the appearance of "Astra Castra"—surely, having regard to the limitations imposed upon it by the period, one of the most remarkable works ever compiled—not a single work should have been published in the English language that has continued Mr. Hatton Turnor's task and brought it up to date at all adequately. And yet the history of aërial navigation during these last years is one of the most thrilling, most deeply interesting, subjects that ever stood ready for an author's hand; beyond that, "Astra Castra" has long since been out of print, and those rare copies of this work that occasionally appear in the market are immediately snapped up by fortunate collectors—nevertheless, there has not hitherto appeared an efficient substitute. Now, while it would be hardly fair to Mr. Charles Turner to suggest that this excellent work of his replaces "Astra Castra"—which will always remain a classic—we can, nevertheless, assert

without much fear of contradiction that "Aërial Navigation of To-day" is the first modern English book that gives a reliable record of the beginnings, the rise, and the development of the history of aërial navigation. There exists a tendency nowadays contemptuously to regard the history of aëronautics as a useless thing, though harmless, and beneath the notice of the practical experimenter or aviator. No greater mistake could well be made; the lessons learned from a study of the history are invaluable. To give but a single practical instance: Sir George Cayley's researches, published in 1810, anticipated in almost every material particular the modern aëroplane, and might very well, had they not been subsequently neglected, have made aviation a reality several decades ago. But to return to Mr. Turner's book; the portion dealing with the historical development of aeronautics from the earliest times is complete and trustworthy, and brings out very ably the intense fascination of the subject. But this portion of the book merely forms an introduction to a careful and thorough statement of the entire principles underlying the science of aeronautics. The following list of a few of the chapter-headings will convey an excellent idea of the scope of the work: Principles of Ballooning; Dirigible Balloons; Principles of Mechanical Flight; The Aërial Ocean; Special Charts and Landmarks; Strategy and Aërial Invasion; Aërial Law, Limitations of Flight; Aëronautical Equipment; Typical Flying Machines and Dirigible Balloons. The inclusion of a chapter on the atmosphere and its phenomena is welcome and valuable; there is a complete illustrated glossary and a number of useful tables, relating to the specific gravity of various woods and gases, to weight and wing-surface, to lift and drift, etc., various conversion tables, and an excellent index. The illustrations have been carefully chosen. One of the best features of this thoroughly sound and conscientious book, which we can cordially recommend, is the treatment of the material which not only brings it thoroughly up-to-date, but is likely to keep it so for some time to come.

"The Conquest of the Air," by Alphonse Berget (London: W. Heinemann, 1909; pp. 295; 12s. 6d. net).—Dr. Berget, professor at the Institut Océanographique, and past president of the Société Française de Navigation Aérienne—the oldest aëronautical society in the world but one—is a scientist of high repute and better qualified to deal with the subject of aëronautics than the majority of his *confrères*. His work, "La Conquête de l'Air," published in Paris early this year, has been brilliantly successful, and deservedly so, since it was undoubtedly the best work setting forth lucidly and directly, but always from an expert standpoint, the basic principles of aërial navigation. It is always a difficult matter to give a complete, yet clear and popular, explanation of a new and complex science whose principles the public has not yet assimilated. But Professor Berget succeeded remarkably well. His work was fundamentally complete and yet written throughout in simple and direct language. Mr. Heinemann, then, was well advised to publish an English translation of this excellent book. Unfortunately, the present translation has robbed the work of much of its value; its best features—simplicity and clearness of language—have disappeared. Not only has the translation been effected in a most slovenly manner, but the translator is so obviously unacquainted with even the most general French and English technical terms that one can scarcely read through a single page without exasperation. Apparently the translator himself was aware of his deficiencies since he has besprinkled every page with a multitude of words—usually of the simplest and most innocuous nature—placed within inverted commas. We constantly meet with such words as "stabilisater," and "stabilisating"; the horrible term "aviation apparatuses" is liberally scattered throughout the work; "closed circle" appears as the translation of, presumably, "circuit fermé"; "thrust" is constantly used instead of "pressure," and on one occasion at least (p. 163), the word "aviator" denotes an aëroplane. The two following instances are particularly exasperating. On page 157 we have the following passage: "Its essential organ is the sustaining or supporting surface. This area is sometimes called the 'set of sails.'" This cryptic expression presumably is an attempt to translate the term "voilure." On page 121 bird flight is divided into three categories: "There is, first of all, the *oary* flight. . . . Then, there is the *soaring* flight. . . . Lastly, certain large birds practise the *sail* flight." For the benefit of the mystified reader we hazard the conjecture that these terms are a translation of the expressions "vol ramé," "vol plané," and "vol à voile," whose true meaning, in the order stated, is "flapping or rowing flight," "gliding flight," and "soaring flight." In the false use of another term the translator is not, however, to blame; on several occasions (notably on p. 170) the word "aëronautics" is used to denote navigation by dirigible as opposed to aviation; let us once again insist upon the fact that the term "aëronautics" is a general one, denoting the entire science of aërial navigation, and that aviation is merely one of its sub-divisions. That this book should have been spoiled in the process of translation is doubly unfortunate since it was, in its original form, a brilliant work of undoubted value. The chapters on the principles of the dirigible and of aviation, illustrated by excellent diagrams, form quite the best and most lucid statement of these problems that has yet come to our knowledge. No better, no more competent, introduction

to the study of aëronautics could well have been imagined. One or two minor errors of fact fail to impair the value of the original matter; the "Gross" dirigible is not non-rigid (p. 108); Hargrave, not Hargreaves, invented the box-kite; the inclined plane for elevating purposes was first practically and successfully employed by Monck Mason in 1843, forty years before it was adopted by Colonel Renard (p. 151); the map of Blériot's cross-Channel flight (p. 213) is inaccurate; and the brief mention of Langley's experiments (p. 243) is misleading and totally inadequate. Paper, print, and binding are alike excellent; the book is splendidly illustrated; its whole "get-up," in fact, is what one is accustomed to look for from Mr. Heinemann. The greater pity, then, that so fine, so thoroughly competent, a work should have been spoiled so signally.

"Fliegende Menschen," by Lieut.-Col. H. W. L. Moedebeck (Berlin: Otto Salle, 1909; pp. 98; 8 plates and 67 illustrations; 3 marks).—Among the indigestible mess of aëronautical literature that has recently poured from the press into the open maw of the public one is glad to find one work at least of merit, and to which unreserved commendation can be extended. There is no need to enlarge upon the author's special qualifications to write a historical *résumé* such as the book under review; we will content ourselves with the assertion that no one has ever produced a better. The two essential qualities, conciseness and trustworthiness, are displayed in an unwonted degree in this work, which, as stated in the Preface, is intended for the "cultured layman," but which will undoubtedly be received with fully as warm a welcome by that specious individual, the expert. The single slight, very slight, fault we have to find is the title—"Flying Men"—but, then, the "cultured layman" is, no doubt, responsible for that. A quotation from the Preface will convey an accurate picture of the merits of Lieut.-Col. Moedebeck's new book:

> "In contrast to other books of this nature, I have endeavoured to present my facts systematically. . . . With regard to dates I have aimed at absolute accuracy. . . . Should the reader notice the omission of many names that figure prominently in every other work of this kind, he must ascribe this to the novel treatment which has omitted with a critical hand . . . everything that has not had an important influence on the development of aviation."

A quarter of the book is devoted to the history of aviation until the last few years; the remainder gives a brief and accurate picture of its present state. The best feature of the work is the convenient and able manner in which the separate development of the three great types—wing, screw, and plane—is maintained throughout.

"The Force of the Wind," by Herbert Chatley, B.Sc. (London: Charles Griffin and Co., 1909; 83 pp.; 3s. net).—This little book should be found most useful by engineers; and though not primarily intended for aëronautical students, it can be read by them with considerable advantage. The scope of the volume is best given in the headings of the chapters: The Practical Importance of Wind Pressure; The Impulsive Force of the Wind; Variations in Velocity; Stream-Line Theory; Stress in Structures due to Wind; Windmills; Train and Motor Resistance; Effect of Wind on Water; and The Scouring Effect of the Wind. A remark on windmills will bear quotation here. "It is customary," says the author, "to confuse wind wheels with propellers. Although in some respects the one is the converse of the other, yet two very important points compel us to treat them differently. (1) There is no motion of the wheel in the direction of the wind; (2) Owing to a continuous and previously undisturbed supply of air meeting the wheels (except above a certain high critical speed), there is no question of the blades diminishing each other's action."

"Practical Kites and Aeroplanes," by Fredk. Walker, C.E. (London: Guilbert Pitman, 1909; 80 pp.; 1s. 6d. net).—Though this book is announced as a revised edition, it contains a number of small but irritating errors. Thus, the author is styled "Associate Member of the Aëronautic Institute," which has been dead for many years; and there are slips like, "*chef-d'ouvre*"; "charovolant"; "Mr. *C.* Hargrave"; "Major-*General* Baden-Powell," and so on. As a hand-book on kite-making it has some little value, and contains many useful tables; but it is distinctly out-of-date and needs not revision but re-writing.

CORRESPONDENCE

The Photography of Aeronefs

To the Editor of *The Aëronautical Journal*

SIR,—In answer to your request, I have pleasure in sending you the following particulars relating to the photographs (reproduced on page 112).

The first photograph is the Clément Bayard airship, "Colonel Renard," rounding the course at Rheims, when it gained the prize for speed. This photograph was taken at 4.15 p.m., on August 29, 1909, at an aperture of $f/6.6$, and at a speed of 1/200 of a second.

The second photograph shows Rougier on a Voisin machine. This was taken at

4.40 p.m., on August 30, 1909, at a speed of 1/225 of a second, aperture $f/6.6$.

In view of the fact that the machines are generally flown in the evening, when the light is non-actinic and yellow, it is well to use very rapid plates, and also to give as slow an exposure as possible, without getting movement of the machine in the picture.

I have found that the Imperial Non-Filter Plate, speed 200 H & D, is very suitable; another plate which I used at Juvisy, and which gave very good results indeed, is the New Barnet Super Speed Ortho Plate, which has a speed of 400 H & D.

I would strongly recommend, as the result of my experience, the use of one or other of these plates for photographing in poor lights. The plates should be backed.

At Juvisy, the machines did not fly until it was quite dull, and therefore I was forced to lengthen my exposure to 1/112 of a second. I found that the machine in the photographs did not show any appreciable movement at this speed.

As the result of trying many developers, I would strongly recommend for flying machine work the use of the Imperial Standard Pyro Quinol Developer.

Trusting that these particulars may be useful,

I am, yours very truly,

ALBERT P. THURSTON

October 14, 1909

Foreign Aëronautical Publications

(In this list a selection of the more notable articles only is given.)

L'Aërophile

July 1st, 1909.—The Dirigibles. Aëroplanes.—The New Balloon Shed at Moisson.—The Aviation Week at Rheims.

July 15th, 1909.—A Starting Platform.—The Question of Helicoptères.—Aëroplanes.—The Dirigibles.

August 1st, 1909.—Aërodynamical Researches.—A Code for Aëronauts.—Sailing Flight Aëroplanes.—The Calais to Dover Flight, by Blériot. The Dirigibles.

August 15th, 1909.—Aëroplanes.—The Dirigibles.—Blériot's Triumph.

September 1st, 1909.—The Great Aviation Week at Rheims.—Aëroplanes (Goupil).—The Dirigibles.—Aëronautical Maps.

September 15th, 1909.—After the Great Week.—Aviation at Donai and Rheims.—Aëroplanes.—The Dirigibles.—The Rights of Aëronauts (The International Aëronautical Convention).

Aëronautics (U.S.A.)

July, 1909.—The Joys of Ballooning.—Talks with Inventors.—At Morris Park.—News in General.—Foreign Letter.

August, 1909.—On the Wright trials at Fort Meyer.—Aëronautic Construction Aids.—At Morris Park.—Gliding from a Hot Air Balloon.—Foreign Letter.

September, 1909.—High Explosives in Aërial Warfare.—The Curtiss Aeroplane.—Construction Aids.—Talks with Inventors.—At Morris Park.—Air Propeller Problems.—Foreign Letter.

La Revue de l'Aviation

July, 1909.—On the Rotary Wing of Mons. Fillippi.—Official Results of Motor Trials.—The Osiris Prize.—Aviation of the Month.—The Stability of Aëroplanes.

August, 1909.—The Crossing of the Channel.—Aëronautics and the Army.—Aviation at Donai.—How I Crossed the Channel, by L. Blériot.—The Crossing of the Channel.—The Dirigible "La Belgique."

September, 1909.—Aërial Locomotion and the French Parliament.—The Rheims Meeting.—The Antoinette Monoplane.—The Dirigibles.

L'Aëro Mecanique

July 10th, 1909.—The Soltau Ornithoptère.—The Belgian Wing Committee.—Dynamic Flight.—The Gnome Motor.

August 10th, 1909.—The Crossing of the Channel.—Considerations on Aërial Navigation.—The Carlhausen Flying Machine.—The Bianco Ornithoptère.—The Bulot Motor.—The Wing.

September 10th, 1909.—Betheney Ornithoplanes.—The Resistance of the Air.—The Curtiss Biplane.—The Wing.

Illustrierte Aëronautische Mitteilungen

July 14th, 1909.—The International Airship Exhibition.—Airships at the I.L.A.—French Machines, The "Belgique."—Miscellaneous Notes.

July 28th, 1909.—Aërology and Airships.—Kites, etc., with the Danish Expedition.—Kite Stations on the Bodensee.—Weather Charts.—Aëronautics in France.

August 11th, 1909.—The International Airship Exhibition.—In a Balloon Over the Alps.—On Flying Machines (G. Wellner).

August 25th, 1909.—An Airship of 200 Years Ago.—Historical Section of the I.L.A.—The German Airship Map Commission.

September 8th, 1909.—The Great Flying Week at Rheims.—Zeppelin III.—The German Airship Map Commission.

Wiener Luftschiffer-Zeitung

July 1st, 1909.—The International Airship Commission.—The Gordon-Bennett Race.—Notices.

July 15th, 1909.—Practical Airship Work.—At Port Aviation.—The Zeppelin.

August 1st, 1909.—The Channel Flight.—The Dirigible "Ville de Nancy."

August 15th, 1909.—The Flying Machine.—A New World Record (Sommer's Flight).—Zeppelin II.—The Gross II.—The Parseval.

September 1st, 1909.—Flight.—The Week at Rheims.—Zeppelin in Berlin.—The Balloon Shed for the "Belgique."

September 15th, 1909.—Practical Airship Work.—Airships in Polar Regions.—At Frankfort.—Wright in Berlin.—Hof-Prof. G. Wellner.

Societa Aëronautica Italiana

July, 1909.—Disturbances Produced by a Balloon in the Electrical Field.—Aëronautical Chronicle.—Miscellaneous Dirigibles.—New Aëronautical Motors.—Miscellaneous Notes.—Scientific Chronicle.—On Aëroplanes (from the "Bulletin Technologique").

August, 1909.—On the Trajectory of Pilot Balloons Launched near the Sea.—The Aëroplane in War.—Aëronautical Motors (Castagneris).—Scientific Chronicle.—Aëroplanes Dirigibles.—Notes.—The Aërial Fleets of Different Nations on August 30th, 1909.—Aërial Propellers.

September, 1909.—The Sixth International Aërological Congress at Monaco.—Aëronautical Chronicle.—Aëroplanes Dirigibles.—Shed Construction in England and France.—Scientific Chronicle.—Contribution to the Study of Aëroplanes (from l'Aërophile).

The American Aëronaut

September, 1909.—Fighting in the Air.—Our Champion at Rheims.—The Flights Above the English Channel.—"Ila."—The Aëronautical Exposition.—The Revelations at Fort Meyer Aërodynamical Laboratories.

L'Aëronaute

July 15th, 1909.—Practical Points in Connection with Flying Machines.—The Work of Penaud—Trials; Crossing the Channel.

August 15th, 1909.—Practical Points in Connection with Flying Machines.—The Work of Penaud.—Crossing the Channel.—On the Theory of Sustentation by Concave Surfaces.—Trials.

Applications for Patents

(*Made in July, August, and September*, 1909.)

The following list of Applications for Patents connected with Aëronautics has been specially compiled for the AËRONAUTICAL JOURNAL by Messrs. BROMHEAD & Co., Patent Agents, 33, Cannon Street, London, E.C.

JUNE

14990. June 28th. H. D. BOULTBEE. Improvements in and relating to flying machines, gliders, and the like.

15013. June 28th. C. J. SUTTON. Improvements appertaining to aerostats and aeroplanes or flying machines.

15022. June 28th. R. F. MACFIE. Automatic balance for aeroplanes.

15109. June 28th. A. J. FREDRIKSON. Improvements in propelling and steering apparatus for motor boats, steam boats, airships, and the like.

15110. June 28th. A. J. FREDRIKSON. Improvements in or connected with airships or dirigible balloons.

15195. June 29th. J. R. PORTER. Improvements in and relating to airships.

15233. June 29th. F. VON EHRENBERG. Safety anchor for airships and the like.

15271. June 30th. T. JOHNSON. Improvements in aeroplanes or flying machines.

15291. June 30th. E. W. YOUNG. Improvements in aerial machines.

JULY

15402. July 1st. J. MEANS. Improvements in aerial navigation.

15415. July 1st. O. HALBACH. Improvements in aeroplanes.

15422. July 1st. E. R. G. DYBERG. Improvements in flying machines.

15510. July 2nd. J. W. TIERNEY. Improvements in and relating to aeroplanes.

15542. July 3rd. C. J. BELLAMY. Improved airship.

15564. July 3rd. W. BIRD. Improvements in or relating to airships.

15577. July 5th. B. H. BALASSANIAN. Soaring machine.

15587. July 5th. R. P. FAY AND J. WILKINSON. Improvements in or relating to aerial or flying machines or apparatus.

15637. July 5th. R. ESNAULT PELTERIE. Improvements in aeroplanes.

15675. July 6th. W. TATTERSALL. Improvements in the construction of airships, and means for operating the same.

15676. July 6th. W. TATTERSALL. Improvements in apparatus for heating air by steam.

15677. July 6th. W. TATTERSALL. Improvements in apparatus for balancing aeroplanes and airships.

15801. July 7th. H. BLACKBURN. Improvements in aeroplanes.

15831. July 7th. E. V. HAMMOND Improvements in and relating to aeroplanes and flying machines.

15885. July 7th. K. TUTZER. Improvements in and relating to airships.

15940. July 8th. J. RATHMILL AND F. THORLEY. Improvements in aerial propellers.

15951. July 8th. H. C. CALLAWAY. Improvements in aerial navigation apparatus.

15963. July 8th. R. H. RIDOUT. Improvements in flying machines.

16010. July 8th. H. H. SIMMONS. Improvements in or relating to the manufacture of material for balloons and other articles whose walls are to resist the passage of gas.

16011. July 8th. A. M. GROSE AND N. A FEARY. Improvements in or relating to aeroplanes.

16045. July 9th. A. RAUSCH. Improvements in and relating to airships.

16068. July 9th. O. WRIGHT AND W. WRIGHT Improvements in mechanism for actuating the rudders or controlling planes of aeronautical machines.

16077. July 9th. J. PARSONS AND J. HENWOOD. Improvements in flying machines.

16085. July 9th. W. SYDNEY. Flying bird.

16107. July 10th. R. J. URQUHART. Improvements in and relating to masked shelters or berths for military flying machines or airships.

16274. July 13th. W. H. HOWARTH. Improved flying machine.

16303. July 13th. W. COCHRANE. Improvements in flying machines and the like.

16367. July 13th. F. W. DUFWA. Improvements in flying machines.

16494. July 15th. W. C. JOHNSON. Improvements in flying machines.

16623. July 16th. G. MARSHAL. Improvements in connection with airships and the means of navigating the same.

16677. July 17th. L. MERLET. Improvements in aeroplanes.

16707. July 17th. H. WATSON. Improvements in aerial craft.

16747. July 19th. A. NEWALL. Improvements in aeroplanes and the like.

16785. July 19 h. N. R. GORDON and E. W. BARTON-WRIGHT. Improved flying machine.

16786. July 19. A. GLENN. Combined air propeller and sustainer.

16829. July 19. Z. Z. WOOLERY. Improvements in parachutes.

16868. July 20th. F. E. JACKSON. Improvements in kites or aeroplanes.

16971. July 21st. B. F. S. BADEN-POWELL. Improvements in dirigible balloons.

17053. July 21st. G. STEVENSON. Improvements in propellers for ships and aeroplanes.

17131. July 22nd. J. MUCKLE. Improvements in ships for aerial and nautical navigation.

17173. July 23rd. H. W. COOK AND G. RHODES. Captive aeroplane for recreative amusement.

17291. July 26th. H. D. BOULTBEE. Improvements in or relating to aeroplanes, flying machines, gliders, and the like.

17295. July 26th. H. T. GRAINGER Dirigible air sailer.

17307. July 26th. J. L. GARNED. Improvements in or connected with aerial machines.

17310. July 26th. B. F. S. BADEN-POWELL. Improvements in aerial machines.

17343. July 26th. G. H. BROWN-EKINS. Improvement in aeroplanes and flying machines.

17456. July 27th. P. J. L. JEZZI. Improvements in and relating to the construction of struts or supports for aerial machines.

17552. July 28th. W. S. SIMPSON. Improvements in apparatus connected with aviation.

17569. July 28th. A. J. BOULT. Improvements in or relating to aeroplanes.

17613. July 29th. S. BROWN. Improvements in and applicable to airships and the like.

17668. July 29th. K. KIKSSICH. Flying machine.

17678. July 30th. A. D. FRIS. Improvements in flying machines.

17811. July 31st. G J. BASELEY AND C. J. GLANVILLE. Improvements in aeroplanes.

17857. July 31st. C. HUBER. Improvements in framework structures for balloons.

AUGUST

17986. August 4th. J. POND. Improvements in flying machines.

17993. August 4th. J. MILLER. Improvements in and relating to flying machines and the like.

18008. August 4th. C. BOUSTEAD. Improvements in aeroplanes.

18083. August 5th. W. CLARK. Improvements in the construction of flying machines.

18040. August 5th. W. TATTERSALL. Improved floating and harbour for aerial vessels which may be used as a fort.

18041. August 5th. W. TATTERSALL. Improved shelter and harbour for aerial vessels on land.

18055. August 5th. J. H. HALL. Improvements in airships, aeroplanes, and the like.

18068. August 5th. J. S. FAIRFAX. Improvements in or relating to machines or apparatus for navigating the air and water.

18095. August 5th. W. R. Buckingham. Improvements in gas envelopes for dirigible balloons.

18096. August 5th. C. H. Rollison. Improvements in and relating to aeroplanes.

18097. August 5th. J. Seiler. Improvements in aeroplanes.

18116. August 5th. A. De Bajza. Improvements in airships.

18138. August 6th. S. L. Walkden. Improvements in aeroplanes and the like.

18174. August 6th. H. F. Phillips. Improvements in or relating to the steering of flying machines.

18204. August 6th. M. Hartz. Apparatus for aerial navigation.

18205. August 6th. J. Cowburn. Improvements in and relating to aeroplanes and means for propelling the same.

18212. August 6th. R. Schwabs. Improvements in flying machines.

18234. August 6th. A. C. Wetzel. Dirigible airship.

18237. August 7th. W. H. Clegg. Improved apparatus for aerial flights.

18303. August 9th. F. W. Lanchester. Improvements in the propulsion mechanism of aeronautical machines.

18318. August 9th. M. V. May. Improvements in airship garages.

18327. August 9th. A. M. Duckham. Improvement relating to balloons or flying machines.

18344. August 9th. O. Coates. Improved construction of aerial machine.

18374. August 9th. A. Allan. Flying machine without aerostat structure propelling, steering, and the like.

18375. August 9th. W. H. Von Mach. Process for protecting balloons against catching fire.

18384. August 10th. F. W. Lanchester. Improvements in alighting mechanism.

18459. August 10th. R. A. Katz. Improvements in enclosures or shelters for dirigible balloons, airships, and the like.

18486. August 11th. H. Garland. Improvements in the construction of aeroplanes and the like.

18525. August 11th. M. von May. Improved construction and method of erection of airship garages, halls, and like structures.

18546. August 11th. M. Vinogrado. Improvements in aerial and marine propellers.

18620. August 12th. W. S. Carr. Improvements in and relating to flying machines.

18634. August 13th. R. G. May. Improvements in aeronautics.

18639. August 13th. W. F. Hume. Navigable flying machine.

18651. August 13th. A. Glenn. Improvements in means for maintaining the balance of vessels in the air.

18688. August 13th. W. Rettig and M. Koenan. Improvements relating to balloon envelopes.

18710. August 13th. B. Wassermann. Improvements in dirigible airships.

18722. August 14th. A. Szek and J. T. Szek. Aerial navigation.

18751. August 14th. W. H. Appleby. Improvements in and relating to aeroplanes and flying machines.

18766. August 14th. C. W. Couche. Improvements in or relating to aeroplanes.

18767. August 14th. J. Schilling. Improvements relating to balloons, airships, and the like.

18768. August 14th. P. Jensen. Improvements relating to the gas bags of balloons, airships, and the like.

18777. August 16th. A. S. John. New or improved form of driving aeroplanes, monoplanes, airships, and the like.

18796. August 16th. E. Klaber. Improvements in and relating to aeroplanes and other means of aerial locomotion.

18829. August 16th. A. Rogestvensky. Improvements in aeroplanes.

18892. August 17th. J. Struthers. Improved aeroplane or airship.

18899. August 17th. W. G. Hicks. Improvements in or relating to aerial machines.

18909. August 17th. G. D. Vaughan and G. H. Mortimer. Biplane.

18972. August 18th. W. Tattersall. Improvements in airshps, aerial harbours, and aerial forts.

18976. August 18th. W. H. Dunkley. Improvements in the construction of flying machines.

18982. August 18th. A. E. Downing. Improvements in flying machines and the like.

19005. August 18th. J. Riley. Improvements in airships or vessels.

19006. August 18th. M. G. Klean. Improved aeroplane.

19046. August 19th. A. Yarwood. Propeller or tractor for giving vertical, horizontal, or other movement or motion to vessels, planes, machines, or other bodies, which move in either air, gas, or water, or are borne by either air, gas, or water.

19163. August 20th. D. R. Bruce. Improvements in flying machines.

19198. August 20th. W. J. Potter. Improvements in aeroplanes.

19208. August 20th. L. Bleriot. Improvements in aeroplanes and similar apparatus.

19216. A. E. High and S. F. Edge. Improvements in flying machines.

19240. August 21st. J. P. Glover. Airship.

19265. August 21st. C. LORENZEN. Improvements in flying machines and screw propellers therefor.

19266. August 21st. J. LYLE. Improvements in means and apparatus for rising into and traversing the atmosphere.

19303. August 21st. J. MENIER. Improvements in spring balloon valves.

19315. August 23rd. WOLSELEY TOOL AND MOTOR CAR CO., LTD., and A. A. REMINGTON. Improvements in airships with a view to preventing loss of weight resulting from consumption of fuel.

19327. August 23rd. T. BETTNEY. Improvements in aeroplane propellers.

19345. August 23rd. M. LANDAU. Improvements in airships and other aerial apparatus.

19405. August 24th. L. B. GOLDMAN. Improvements in aerial machines.

19415. August 24th. H. J. ROGERS and W. BEEDLE. Improvements in aeroplanes.

19473. August 25th. W. TATTERSALL. Improved reversible aerial propeller and fan for moving air.

19493. August 25th. G. T. MONEY. Flying machine.

19540. August 25th. J. MEANS. Improvements in emergency apparatus for controlling flying machines.

19548. August 25th. J. V. L. HALL. Improvements relating to aeroplanes.

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20296. September 4th. H. A. Thiersch. Improvements in aeroplanes.

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